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THE AMERICAN GAS LIGHT JOURNAL

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[OFFICIAL NOTICE]

Committee on Federation, American Gas Light Association.

AMERICAN GAS LIGHT ASSOCIATION,
OFFICE OF THE SECRETARY, PROVIDENCE, R. I., Dec. 21, 1893.

To the Editor AMERICAN GAS LIGHT JOURNAL:

You are hereby notified that in accordance with the vote passed by the Association on October 18th, adopting the Report of the Committee on President's Address (See JOURNAL, Nov. 6, page 653), the following named members have been appointed a Committee on Federation, as called for in the first section of said Report.

W. R. Addicks, Chairman, Boston, Mass.; Geo G. Ramsdell, Philadelphia, Pa.; Chas. H. Nettleton, Birmingham, Conn.; Wm. R. Beal, New York, N. Y.; B. E. Chollar, St. Louis, Mo.

Respectfully, A. B. SLATER, JR., Secretary.

BRIEFLY TOLD.

NINETEENTH ANNUAL MEETING OF THE SOCIETY OF GAS LIGHTING.—The Nineteenth Annual Meeting of the Society of Gas Lighting was held, on the 14th inst., at the 18th Street Station of the Consolidated Gas Company, New York, with a good attendance, both of the resident and out of-town members. The proceedings were enacted in the spirit of harmony that always characterizes the assemblages of the Society. The President in reviewing the records for the twelvemonth congratulated the members on their fealty to the aims and objects of the Society, the progress of which for the past 19 years had been noted for its evenness, and predicted that its future records would be those indicating extended usefulness in a widening sphere. He also alluded feelingly to the great loss sustained by the Society in the death of its ex-Treasurer, Mr. Wm. Combe. The annual reports of the officers, all of which were of a most satisfactory nature, having been received and approved, the annual election was proceeded with, those chosen being:

President—Jos. R. Thomas.
Vice-President—Eugene Vanderpool.
Secretary—F. S. Benson.
Treasurer—A. M. Smith.
Finance Committee—C. H. Nettleton, A. B. Slater, H. F. Allen.
Member of Executive Committee—F. C. Sherman.

Routine business having been disposed of the members partook of the annual dinner, which was enjoyable on every account. The next meeting of the Society will be held at the works of the Nassau Gas Light Company, Brooklyn, N. Y.

THE NEW YORK "HERALD" AND THE NEW HOLDER AT 65TH STREET.—The New York *Herald* is a pretty good newspaper, that is from day-in to day-out; furthermore, its management is ambitious and astute. Perhaps, however, its great hold is in the collection for dissemination of general news, rather than in the compilation of articles on the subject of engineering, for instance. Still its young men, and as matter of fact, its old ones, too, can never be brought to acknowledge that any subject is too deep for them, or that it is beyond the range of their mastering; so it is not to be wondered at that occasionally mistakes are made, especially when the subject of "the assignment" is a trifle out of the ordinary. The issue of the *Herald* for the 17th inst. contains an article on

the new holder now in process of construction, and pretty well along towards completion, for the Consolidated Gas Company, close to the foot of West 65th street. The headlines of the article in question declare that this holder is the largest in the world, but the writer of the description is more modest, and very much nearer to the truth in his claim, when he says that "there is but one other in the United States that even approaches it in size, and it is in Chicago." So far as the headline is concerned we have only to remark that in London, England, there is at least one holder with a capacity of 12,000,000 cubic feet, and that in the same country there are several the capacity of which will exceed 5,000,000 cubic feet. Coming to the claim respecting the Chicago holder, we have to sorrowfully admit that the Chicago Gas Light and Coke Company's holder is considerably larger than the New York example; and there the Windy City has us again. To be precise about it we will give the dimensions of each, giving first the figures concerning the Chicago holder:

Tank.....	190 ft. 0 ins.	diam. by 43 ft. 6 ins.	deep.
Inner section.....	179 ft. 6 ins.	" by 42 ft. 9 ins.	"
Second section.....	182 ft. 0 ins.	" by 42 ft. 3 ins.	"
Third section.....	184 ft. 6 ins.	" by 41 ft. 9 ins.	"
Outer section	188 ft. 0 ins.	" by 41 ft. 3 ins.	"

Working capacity... 4,289,500 cubic feet.

The dimensions of the New York holder are:

Tank.....	187 ft. 0 ins.	diam. by 43 ft. 6 ins.	deep.
Inner section.	177 ft. 9 ins.	" by 42 ft. 4 ins.	"
Second section.....	180 ft. 0 ins.	" by 41 ft. 10 ins.	"
Third section.....	182 ft. 3 ins.	" by 41 ft. 4 ins.	"
Outer section.....	184 ft. 6 ins.	" by 40 ft. 10½ ins.	"

Working capacity....4,106,000 cubic feet.

While it is true that both holders, considering the magnitude of the scale of their construction, approach each other closely in dimension, it is also nevertheless true that the difference in their actual storage capacity (183,500 cubic feet) represents a storage provision that exceeds the storage provided by at least 40 per cent. of the separate gas companies of the country. In other words, that 40 per cent. of the gas companies of the United States and Canada would have sufficient or greater storage capacity for their daily needs, were they the possessors of a holder calculated to retain 183,500 cubic feet of gas. In conclusion we might remark that both holders are alike creditable to their owners and builders, as each vessel is a magnificent specimen of engineering.

MR. VANDENBERGH'S MISTAKE.—In our last issue we had something to say about the fractured condition of the photometrical apparatus owned by the city of Buffalo, and with which the City Chemist was supposed to test the illuminating value of the gas supplied to the corporation by the Buffalo Gas Companies. Incidentally we referred to the fact that Mr. Vandenbergh, who formerly occupied the position now held by Mr. Hill, never had any trouble in making the tests, and we thought our reference to him was put plainly enough to show that during his (Vandenbergh's) term of office the duties thereof were carried out as they should have been. And we still think our reference is susceptible of no other construction. However, on the 20th inst. we received a letter from Mr. Vandenbergh, a portion of which is as follows: "An editorial in the JOURNAL for December 18th contains the following: 'Mr. Vandenbergh' [as City Chemist] 'found no difficulty in keeping official record at appropriate intervals of the candle power of Buffalo's gas during his term of office, to which we might also add that he never found it below the legal requirements.' This is substantially true, but I take exception to your gratuitous comment, 'Nor could he well do otherwise, considering the "missing links" in the apparatus.'" The complete sentence referred to by Mr. Vandenbergh is as follows: "The City Chemist, who is a very competent gentleman named Hill, acknowledged that he had made no tests of the gas since he assumed his office—he succeeded Mr. Vandenbergh, who found no difficulty in keeping official record at appropriate intervals of the candle power of Buffalo's gas during his term of office, to which we might also add that he never found it below the legal requirements—nor could he well do otherwise, considering the 'missing links' in the apparatus." If Mr. Vandenbergh will carefully read the sentence, he will of course see that the only reference to himself is contained in the words embraced by the dashes. Suppose we leave that matter out; how would it look to Mr. Vandenbergh then? About like this: "The City Chemist, who is a very competent gentleman named Hill, acknowledged that he had made no tests of the gas since he assumed his office, nor could he very well do otherwise, considering the 'missing links' in the apparatus." We would have made no reference whatever to this were it not for a request made by Mr. Vandenbergh in his letter that we would make the latter "a text for a short editorial paragraph in as prominent a place as that of December 18th." We have done so.

WE regret to announce the death, on the 19th inst., of Mrs. Louisa Clement White, widow of Colonel Ambrose J. White, and mother of Capt. W. Henry White. The funeral services were celebrated in Brooklyn, N. Y., on Friday last.

Oil Gas and Bye-Products from Mineral Oils.

[A paper read by Mr. J. Laing, of Edinburgh, before the Royal Scottish Society of Arts.]

Two years ago, I had the honor of bringing before the Fellows of this Society a paper on the "Destructive and Conservative Distillation of Mineral Oils;" and I may mention that what I am now about to ask your attention to for a few minutes is the outcome of extended experiments on the subject of destructive distillation. Some of you may remember that I pointed out three methods by which mineral oils can be "cracked up" or decomposed. One method was by repeated distillation; another by distilling under pressure; and another by radiant heat—as by passing the oil vapors from a still distilling oil through a superheater, where those vapors come into contact with the radiant heat found there, they are thus further decomposed or broken down. While working with the last mentioned apparatus, I had some trouble in regulating the heat in the superheater I used. If I employed too high a heat, I had my oil "cracked up," but I also had too large a quantity of gas formed of an incondensable character. It was while facing this latter point that the thought struck me, Why not convert the whole of the oil into gas? I extended my superheater and gave it the necessary temperature, and I was quite pleased with the results I obtained.

In order to have a perfect apparatus, several difficulties had to be overcome. When working at a very high temperature in the superheater, as I had it, I found that there was a tendency to have a deposit of coke, and as this was undesirable, the question naturally came to my mind, How can I prevent this tendency to deposit coke, and yet get my gas rendered permanent by using a lower temperature? It then occurred to me that, if I could condense the heavier and more condensable hydrocarbon vapors before they reached the superheater, I could then deal with the lighter vapors and convert them into permanent gas at a lower temperature than what I would require to attack the full flow of vapors as they came from the still. I accordingly fitted up a condenser between the still and the superheater, and allowed the more condensable vapors to be condensed and return to the still for re-evaporation and condensation. By this method I got much better results, and no incrustation of carbon, to speak of, in my superheater. But here another difficulty met me—and a serious one, too—in the presence of water along with the oil in the still. When the temperature of the boiling point of the water was reached, steam was formed and left the still; but readily condensing in the condenser, it returned to the still in the form of water. As the temperature of the still was increasing, the result was that this water, on re-entering the still, immediately burst into steam, and was capable of doing mischief from the sudden pressure it exerted on the plant. To get over this, I introduced a piece of apparatus between the lower end of the condenser and the entrance to the still, which acted as a water trap.

This water trap caught all the condensed material from the condenser, and, as water is heavier than oil, it accordingly sank to the bottom. The overflow of oil from the surface returned to the still perfectly free from water; and during the remainder of the distillation there was no possibility of further trouble or anxiety on account of water in the still. This trap is fitted with a cock at the bottom of it; and when you turn it on and find oil present, you may rest assured that no water is there to be dealt with. Sometimes it happens that water is present in the oil tanks from which the oil is barrelled, and if the tank is well run down, some water may have got into the barrels among the oil unperceived. In this way water may find its way into a still when being charged from the barrels or tank; but with the arrangement I have here mentioned, no harm can result from its presence in my form of apparatus for the manufacture of oil gas.

In the form of apparatus I have adopted, I get the benefit of a combination of the three methods of cracking oils I have already brought before you. [Of course, you will understand that the conversion of oil into gas is nothing more than "oil cracking" carried to the extreme.] There is the re-distillation and condensation, as shown by the condenser coil in connection with the still. Then I get the back pressure on the still from the weight on the gasholders, which enforces distillation under pressure; and then I have the direct action of radiant heat in the superheater.

In the form of superheater I am using at present, I have a number of discs with holes punched over the one-half of each disc; and the edges of the discs are vandyked or nitched. These discs are fitted on to an iron rod, at regular intervals from each other. The end disc has its holes downwards, the next one has its holes upwards, and so on to the end, thus giving the gas a zigzag travel, and making it come in closer contact with the radiant superheater. My reason for giving the gas this

kind of zigzag travel is to insure a uniform quality of gas being made. If you merely pass the gas through to the superheater direct, then the portion of it which is nearest the sides of the vessel is decomposed the most. The central portion is of a heavier nature; and I am strongly under the impression that this mechanical mixture of the molecules (if I may use such an expression) is one great cause why some makes of oil gas smoke so badly when being consumed in the burners. If the hydrocarbon molecules are of a uniform character, then you will have a gas which will give satisfactory results on being consumed. I am quite aware that a proper size of burner should be employed for burning very rich gases, but what I mean to convey is this, that using two makes of oil gas, and consuming them side by side under the same conditions in every respect as to burners, pressure, etc., you will find that the gas which has been the result of uniform decomposition will give more satisfactory results than the gas which is not so uniform in its composition —being more a mechanical mixture of its component parts than a chemical one. Oil gas of uniform composition blends immediately with coal gas, and, I believe, has no tendency to layering in large holders; and accordingly you should have no variation of illuminating value from different heights of the gasholder. Some people seem to think that oil gas does not store well, and loses a great deal of its illuminating power, if it has to travel far. Now this is quite a misconception, for really the fact is that, if oil gas is properly made, it will store better and travel better than coal gas will, for coal gas depends more on condensable vapor for its illuminating power than oil gas does. In some other processes for oil gas making, the oil is injected or run in a stream into the heated retorts or stills. In this way the oil is at once flashed into vapor; what has been rendered permanent goes to the holders, and what condenses again into oil is returned to the still. By this method you obtain an immediate deposit of coke, which goes on increasing in thickness as long as the feed continues to supply the oil. This coke, as you all know, is a very bad conductor of heat; and it necessitates more heat to be forced into the still as the operation of gas making continues, in order to decompose the oil coming into it. By such methods you will see that the resulting gas is very apt to be of a mechanical mixture nature, owing to part of the oil vapors not having come in sufficiently close contact with the heat necessary for their thorough decomposition. The great heat necessary to pass through all this increasing thickness of coke I fear will soon prove a destructive agent on the plant itself, by burning it through.

By my method I never require a higher temperature than a very little over the distilling or boiling point of the oil to be used. I charge my still with a quantity of oil consistent with the number of cubic feet of gas I wish to make; and I distil this down to a thick bottom and run it off as pitch. I have practically a clean still left for the next day's charge. If you prefer having a large size still, then you may work on a large body of oil, distil down as many inches as you require, then draw off the heat and leave the still as it is till next time for making. Nothing leaves the still but vapors, the condensable portion of which continuously washes down the condenser coil and other pipes connected to the still, and keeps them absolutely free from deposit. All the dirt remains in the still, and the cruder the oil used, you have a greater or less quantity of pitch formed. This bye-product is much more valuable as a commercial article than coke. If you allow the distillation to continue to dryness, then, of course, you will have coke formed; but it is better to stop the distillation while the residue in the still is liquid, and it is readily run down, leaving the still practically clean. I may here mention that I have arranged a special pitch cock, which will save a deal of trouble by its being easily kept free from plugging up. In the ordinary cocks at present in use, the box or hole in the plug of the cock generally retains some of the pitch, and as it cannot escape when the barrel is turned off, it remains and hardens there, and, before another run-down can be made, time must be allowed for the hot pitch behind the cock to melt out the plug in the cock barrel. This is sometimes rather difficult to get over, and a steam jet has to play on it for some time before it will clear. To get over all this, I got a cock specially made with a "pap" cast on the one side of it. A hole was then bored through this into the plug box, so that, when the cock was turned off, a hot wire could easily be passed into the plug box, and the hardened pitch removed.

A screw plug fits into this hole. This method is extremely simple and most effective, and far better than the present system of running a red hot rod up a pipe in line with the cock, and with the cock turned on ripping it out. Sometimes the stoppage gives way with a burst; and there is great danger of the person so operating being seriously scalded with the hot pitch from behind coming quicker than he can get the rod removed. With my arrangement, large or small works are equally served; and no duplicating of plant is necessary for large works. You only require to have a larger or smaller still and condenser in proportion, consistent with the amount of gas required.

Any kind or quality of oil can be employed with absolute confidence. I prefer to use the .865 or .840 unwashed home oil, as the gas made from it requires no lime or other purifying treatment. If you use an oil too near the crude state, it would be better to pass the gas made through purifiers, so as to remove all sulphur and ammoniacal compounds, which are apt to be present at that stage. No skilled labor is required. Keeping up a distilling temperature is all that is necessary to give special attention to. The cost of the plant is not great, and the expense for upkeep should be exceedingly small. The space required is very small indeed. Eight feet square would be sufficient for a works requiring 20,000 cubic feet of oil gas or more per day. There is nothing to get out of order—there being no mechanical parts requiring attention. The attendant never requires to soil his person or dress. As in a coal gas works, the air is not polluted with offensive smells.

Where oil gas is being consumed, it should be burnt at less pressure than that used for a poor coal gas; and a size of burner should be used which will just prevent smoking. If you use burners much below this point, you get a very much poorer light per 5 cubic feet burnt, owing to the cooling of the flame. It has been shown that a No. 0 Bray, showing 50 candles per 5 cubic feet burnt, and giving a good smokeless flame, would, if the same gas under the same conditions was burnt in a No. 000 burner, show a loss of 35 candles from the same amount of gas consumed per hour. I find a burner passing about 1¾ cubic feet per hour will answer very well for general requirements.

By arranging a $\overset{A}{\underset{}{\overset{B}{\mathbf{T}}}}$-piece outlet on the still, provided with cocks A and B, as shown, you can have a very useful combination of still suitable for oil and gas making combined. Suppose you have an oil which contains some light material you do not wish to retain, you can convert that portion of it into illuminating gas in the method described, and then by shutting off the cock at A and opening B, you can convey the rest of the vapors of the heavier remaining oil to an ordinary worm condenser, and then run them off in the usual way as heavy oil into the receiving tanks, at the same time shutting off the heat from the superheater, as it would not be required. Should a plant be desired for the combined purpose of making gas and refining oil, it would be well to have provision made for a furnace to assist the surplus heat from the coal retorts (if such heat is being utilized), because a smarter heat is better for distilling oil than for gas making, for the reason that, if your oil vapors are kept too long in the still in contact with the radiant heat there, you would have your heavy oil vapors decomposed, and a lighter oil would be the result. The lower temperature at which you can distil mineral oils will yield you the heaviest qualities, and of greatest viscosity.

It is not my intention here to further occupy your time in bringing forward the advantages claimed for the use of oil gas. These claims have been well ventilated here by others, and also in the public press; but I would just say that I think all gas companies should have an oil gas plant—in reserve, at least, if not in actual work—for, should they run short of coal, through miners' strikes or other causes, they can yet prevent in a great measure having their towns left in total darkness by the timely use of their oil gas plant. You can calculate on getting 100 cubic feet of gas of high illuminating power from each gallon of oil; so the space required for storing an enormous quantity of oil gas in a latent stage (if I may be allowed the expression) is not very great. The question of cost has been well wrought out, and is before the public; and I may only say that, if you are using the surplus heat alone for your oil gas plant, then the cost of the oil gas is practically the cost of the oil you are using.

Discussion.

The Vice-President said he should like to know if it had been settled what was the composition of the oil gas Mr. Laing had described; and whether the condensation he spoke of as belonging to coal gas was not also attendant upon oil gas. He would also like to know whether the gas was suitable for engines, because, if it were, he thought it might facilitate the installation of electric light in small communities where the question of coal carriage was of considerable importance.

Mr. D. Bruce Peebles (Edinburgh) said he was sorry he had not the necessary knowledge to criticize the paper as he would like. Oil gas was, however, a subject which had lately risen very high in discussions in connection with gas. There was a gas which had its origin in the town bearing the unfortunate name of Peebles, and with which he had nothing to do; but he was being continually asked: "What is this new process you are bringing out?" He wrote to Mr. Young, the inventor of that process, asking him to be present that night, if possible, in order

that they might have the matter thoroughly thrashed out; but, unhappily, Mr. Young had been ill with influenza for a fortnight, and could not be with them. He (Mr. Peebles) would like to know, as between the two systems, which would most conduce to economy. He could not say he agreed with Mr. Laing that oil gas should be burned at a lower pressure than other gas. So far as his experience went, a gas of low quality required a very low pressure. For oil gas, the burners had to be very small. He should like to know what illuminating power gas Mr. Laing produced. He himself was not particularly partial to high quality gas. Professor Lewes recommended one of 14 candle power, and he himself was convinced that gas of 20-candle power would be far more suitable for gas engines and gas fires than gas of 26 or 28 candles, such as they had in Edinburgh. He thought Mr. Laing should take advantage of the North British Association of Gas Managers, where he would have a very kind reception, and where the members would be very happy to go hand in hand with him in any experiments he might make. He understood the process was in operation at Linlithgow, and so they would soon have practical results. There was the question of pitch or coke which would have to be discussed. Mr. Laing said he obtained a better product than Mr. Young. The latter gentleman had, however, a very high quality of coke; and the question would be which was the more economical of the two.

Mr. Laing said that, as to the composition of the gas, he was not prepared as yet, from his own knowledge, to give any particular mechanical analysis of it, as he had been too much engaged in the practical and commercial part of the question to take up that point. But there were various analyses which had been made, and it might be taken for granted that they were much the same. He had not tried the gas in gas engines, for the very good reason that he had not had an opportunity; but, from what he had heard from other people who had experimented with oil gas, it was considered that it was better than coal gas. It seemed that, instead of the smart explosion which occurred with coal gas, they had more of the expansive or steam action. As to the storage of oil gas, if properly made there was very little that was condensable in it. He had had it standing in a freezing mixture for a considerable time, and it had hardly any effect upon it. Mr. Peebles had referred to the comparative value of the Young and Laing processes. Well, it was very natural for him (Mr. Laing) to think his was the best; but, apart from that, in the Young process they had a dry vessel, and the carbon adhered to the side of it, and they had an increasing deposit of coke. He thought it was 5½ cwt. of coke per ton of oil that the Young process yielded, and, of course, the increasing thickness of coke necessitated raising the heat put into the retorts. In the process he had shown the meeting, he had nothing of that kind. The heat practically continued to the close, and they had a liquid from beginning to end. With regard to the price of coke as against pitch, it was a matter for themselves to decide. If they wanted pitch, they had only to take it out; but if they wanted coke, they had only to continue it. He thought that, in a question of plant, they would turn it out. Another great advantage was that, when they opened the still to run off the pitch, the still drained itself, and became dry. They did not require to go in and chip out coke. What he meant by his observations about pressure was that they required very much smaller burners for oil gas than for poor gas. With regard to the illuminating power, he thought a very good power to send out to consumers was about 30 candles. In order to get this, what he proposed was to use a very poor splint coal—the cheapest coal they could get—giving 18 candle gas; and if they took five portions of this gas and one portion of oil gas, they would supply to the consumer a 30 candle gas. The oil gas was of at least 90-candle power.

Mr. R. Mitchell (Edinburgh) could not make out Mr. Laing's reference to water in the oil. He said his experience of oil manufacture was that there was no water at all in an oil of .870 specific gravity.

Mr. Laing—The water is not in the oil necessarily; but when oil is run in, water may get into it.

Mr. Mitchell said he never saw it, in all his experience. Mr. Laing had given them experimental results, but not any information as to running off the pitch or with regard to the quantity of pitch that was produced per ton of oil. They had heard from Mr. Young that he had a residuum of 5½ cwt. of coke per ton of oil. He thought that, if they had this quantity of hard, dry coke they would require to get from 7½ to 8 cwt. of soft pitch. The working of a still as compared with working Mr. Young's retort was open to question. He should think the Young process, seeing that the retorts only required to be opened once in 24 hours to remove a small quantity of coke, was preferable to one in which it was necessary to use a red hot bore to run off the pitch. They obtained a marketable article in the one case, and a dirty sludge, which they could not get a market for, in the other. So far as the using of the still was concerned, they would get a very good result at a low temperature. But if they commenced cracking up the oils at a high temperature, they would begin to fail in what they were aiming at; they could not possibly get it. He did not wish to say anything about other processes, because there were so many in the field now; but, so far as he could see, Mr. Laing's might, so far, be successful, though he thought there was something left for that gentleman to attain to.

Mr. Kinloch Anderson (the Convener of the Works Committee of the Edinburgh and Leith Gas Commissioners) said the Gas Commissioners had the subject of the manufacture of oil gas before them at the present time, and they were very much indebted to the pioneers who had put before them the different schemes. They had not yet come to a decision, but were open to conviction that there was still a better process; and if Mr. Laing showed them that his was the best, they might be able to give it further consideration. He was very hopeful that there was a great deal in the manufacture of gas from oil. It was going to serve an important purpose in helping them to cope with the congestion of the coal market which sometimes occurred; and possibly, in the case of a strike, it might serve a good purpose.

Mr. J. Milne (Edinburgh) remarked that, being interested in the other process, he could not, of course, draw any comparisons. As regarded the product, they would naturally have a smaller yield of gas and a larger yield of pitch. He did not think there would be any difficulty in disposing of the pitch. Mr. Laing had referred to the loss of heat in retorts, from the caking of coke. He was inclined to think he was slightly wrong. He was open to correction; but he was under the impression that the coke in the Young process formed in the bottom of the retort, and did not retard anything going through. There was not much loss of heat in the retort. As to the burning of gas in cities, he could not agree with Mr. Laing. He thought that gas of from 20 to 22 candles was far better than that of 26 to 30 candle power. He had the curiosity to look into Mr. Laing's patent, and he found that he had been about this matter for a good while. He noticed that his first application was on March 17, 1890, and he saw that Mr. Laing had had altogether five patents. It looked to him as though Mr. Young and Mr. Laing had been jumping about the same center; that they had started with destructive distillation, and had then taken different routes. There was no doubt both had done a great deal of good, and had afforded much information.

Mr. Mitchell said that there was one point of which he omitted to take notice in his previous remarks, and that was with reference to the use of gas for engines. Some years ago they had a very extensive series of experiments, as to gas of from 16 to as high as 28 candle power, at Birmingham; and the diagrams given showed that the higher the quality of the gas, the more efficient was the action of the engine.

Mr. Hunter (Edinburgh) said he had seen the Young process, but not that of Mr. Laing; and he hoped they would be invited to inspect the latter at Linlithgow, so that they might be able to compare one with the other.

Mr. J. Macfie (Edinburgh) remarked that he was not able to offer an authoritative opinion as to the process before the meeting. He had seen that of Mr. Young at work, and he thought it a beautiful operation. What he would like to know about Mr. Laing's process was as to the permanency of the gas. Until Mr. Young's system came out, the manufacture of oil gas was only experimental, and it was generally asserted that no gas of this kind was permanent. He understood Mr. Young claimed to have overcome this difficulty, and had produced a permanent gas. He thought Mr. Laing had indicated that his was a permanent gas; but he (Mr. Macfie) considered he might be a little more definite upon the point. Nothing had been said as to the value of the coke produced. He understood that at Peebles from 20s. to 21s. per ton had been realized for it; and he believed there was a demand for it for certain metallurgical purposes. It was true that it caked in the retort. But it was very easily withdrawn; and he had not seen it stated that the caking reduced the efficiency of the retort. It seemed to him that the heat which must be required to bring the oil up to the proper temperature would be as great in the one as in the other. He supposed Mr. Laing would admit that his process was more of an experimental one than Mr. Young's. He was sure they all wished Mr. Laing success with his process.

Mr. J. Graham Youll (Edinburgh) thought the water trap was a valuable thing. As to the pitch, it appeared to him that it would be a very much cheaper way of getting rid of the heavy portion of the oil than by coking it. The pitch they obtained by Mr. Laing's process would sell at from 27s. to 30s. per ton at the works; and if a little more of the oil were taken out of it, it might realize from 36s. to 40s. per ton. He had seen a still with 4 or 5 inches of coke in it have liquid oil on the top of the coke. The carbon was a non-conductor of heat.

Mr. Laing, in reply, said he had seen an accident with water in oil which gave him a fright. The pitch he obtained had been referred to as "sludge." He did not think they could speak in this way of the sample he had produced. As to the use of the pitch, the process was in its infancy. The sample he had with him was not a perfect one. If he had been wanting to make a pitch for asphalting purposes, he would have distilled it down and made it more brittle. Mr. Milne had referred to his "jumping about" patents. What that had to do with the matter he did not know. The three patents he had taken out were not for gas purposes; they were for producing light oils from heavy ones. Perhaps Mr. Milne was aware that a large quantity of oil came from Russia, up to .970 specific gravity, which was perfectly useless as it was. It would not burn, nor was it a lubricant, and it was not viscous. As a burning oil it was too heavy—it smoked; and the question was, what they were to do with it. It was when looking for a process for this that he took out his patents. The only "jump" he had taken in the matter was when he found that in experimenting he had too much gas. At that time there was no demand for an oil process for making gas; but when this question arose, of course it naturally occurred to him to turn his process to account. He would be pleased to see the Edinburgh and Leith Gas Commissioners at Linlithgow. He might say that his experience just now was purely experimental. The plant which had been fitted up at Linlithgow was entirely an experiment. They had only made one night's gas by it; and, unfortunately, it was past 12 o'clock before they got up sufficient heat. They obtained a very good result. He was that day making arrangements to get a smarter heat upon the superheater, and in this way he would be able to have gas made in time to send it out to the consumers that night. He could not give an authoritative opinion as to the permanency of the gas; but he had kept it in his laboratory for 36 to 40 hours in a freezing mixture, and there was no change whatever in it. There was no doubt they could do with less heat with pitch in the still than with coke.

The paper was sent to a committee for report.

The Purification of Water, with Special Reference to Boiler Feed Waters and Scale Prevention.

[Read before the World's Congress of Chemists, by Mr. C. A. Doremus.]

Prof. Vivian B. Lewes, of the British Royal Naval College, has epitomized in two papers read before the Institution of Naval Architects in 1889 and 1891 a series of the most highly interesting and instructive analyses and experiments on incrustations in marine boilers and their causes to be found in the literature relating to scale formation. A careful study for some years of a great variety of boiler feed waters from all sections of the country has convinced me that many points brought forward by Professor Lewes are so generally applicable that they can not be overlooked by the chemist who attempts to rectify the serious troubles arising from these sources.

The following quotations are typical: "The presence of calcium sulphate exercises a very marked influence upon the condition and physical properties of the incrustation, as under the conditions in which it is formed in a boiler it separates in a crystalline form and binds the deposit into a hard mass, an action which is also aided by the presence of magnesium hydrate." When calcium sulphate is deposited from sea water in a boiler it comes down in small crystals containing two molecules of calcium sulphate and one of water; whilst after deposition in the boiler and in contact with the heated plates and tubes, it undergoes a further change of crystalline form and becomes "anhydrite, which is pure calcium sulphate free from water of crystallization, and it is this change in crystalline form which binds deposits containing it into such a hard mass."

In many carbonated waters the calcium carbonate also forms upon the heated surface as a crystalline coating, even though the quantity in solution is trivial. Thus, in a Croton water which carries but a grain or two per gallon, a scale forms on all heated surfaces, tubes as well as crown sheets, which is distinctly crystalline. The massive concretions often found in feed water heaters are crystalline in structure and firmly adherent to the hot tubes or surfaces. It is very easy to show this by a simple experiment. Place a carbonated lime water in a beaker. Raise it to boiling by steam delivered into it by a glass tube. The latter will become coated with an adherent crystalline layer of calcium carbonate. With gypsum water the incrustation does not form so readily since calcium sulphate is soluble to some extent in boiling water, and thorough precipitation not taking place before 140° to 150° C., a state of affairs reached in practice in boilers, where the calcium sulphate then separates in a crystalline form and attaches itself to the rough heated metal.

In a paper read at the Newport meeting, I called attention to the use of sodium fluoride as an agent hitherto overlooked in water purification. Since then I have had opportunities to get the results of its use in several lines of work, but the present paper will be restricted to the service this substance renders in scale prevention. Starting with the idea that is so prevalent, that successful treatment of feed waters should be accomplished by such chemical or mechanical, or combined chemical and mechanical treatment, that the incrusting salts should be removed previous to the water entering the boiler, it was soon seen that this theoretical ideal was not practicable. There are many waters which yield an incrustation, whose proportion of lime and magnesium salts is so small that precipitation can not be effected either by the use of feed water heaters or of chemicals. Yet such waters yield a crystalline scale and often a scale containing magnesium hydrate. Surface condensers are frequently leaky, and many marine boilers starting with good water acquire scale from this cause. Manifestly such waters can only be treated by chemical means in the course of concentration in the boilers. From these almost soft waters we pass by upward grade to the excessively hard, which can be purified in some measure merely by heating or by chemicals. Since, however, calcium sulphate is not completely precipitated at 100° C., feed water heaters do not remove it thoroughly enough to prevent scale, and where waters have a permanent as well as temporary hardness due to magnesium salts these are not eliminated. When lime, soda ash, or caustic soda, or a combination of any of these is made use of, it is difficult to regulate the amount required to effect so complete a precipitation that no scale will form, and the trouble attendant on this style of purification is so great that in many cases it has been abandoned. Water softened by lime and soda ash or treated by soda ash or caustic, will generally possess an alkaline reaction, and is, for some purposes therefore unserviceable. The chemical treatment frequently causes the lime salts to separate in crystalline form, large masses of great thickness being formed.

In one instance the feed pipe for a battery of boilers, though 5 inches in diameter, became so incrusted that a 1-inch bar could not be thrust through it. The water had been treated with soda ash and afterwards filtered.

At an artificial ice factory using hard well water the sand of the filter became hard as stone from the calcium carbonate which crystallized upon it even after the water had been treated with soda ash and heated to soften it.

The cost of chemical treatment is often a bar to its employment quite aside from the expense of accessory apparatus, as settling tanks, filters, etc., since to be effective at least the theoretical quantity of precipitant must be used, with soda ash two or three times this quantity.

When sodium fluoride is added to water containing even a very moderate proportion of lime or magnesium salts a precipitate forms at once. When added in quantity sufficient to unite with all of the calcium and magnesium to form fluorides of these metals and the water is then boiled down the precipitate retains its amorphous character. Viewed through the microscope, it has always been found powdery and rounded. This circumstance, together with other considerations, has led to the employment of sodium fluoride in the direction of scale prevention, and it is pleasant to be able to record that to day it is in successful operation in nearly every section of the country.

It is not an uncommon practice abroad[1] to employ sodium carbonate directly in the boiler, transforming the calcium sulphate to carbonate. The conversion not only of the sulphate of calcium but all magnesium salts to pulverulent fluorides therefore seemed possible and has proved practicable. Calcium fluoride has a molecular weight about 25 per cent. less than either calcium carbonate or sulphate, or an equivalent quantity of phosphate, and therefore the precipitate or sludge formed through its use is much more manageable and removable by blowing down the boilers.

At first it was deemed necessary to determine the total calcium and magnesium of the water often to make a sufficiently complete analysis to determine the salts held in solution and to calculate from these data the quantity of sodium fluoride necessary to transform the calcium and magnesium to fluorides.

Carefully made tests have shown, however, that in the greater number of instances a quantity of sodium fluoride, one quarter of this theoretical amount, will, if fed continuously, prevent the formation of scale and leave the interior surface of the boiler so smooth that one chief cause of crystals attaching themselves is done away with.

The various types of water from New York to Albany and from there through the salt district to the lakes at Buffalo are now under this treatment with entirely satisfactory results. The employment of so small

1. L. Vignon, *Bull. Soc. Chim.*, III., 2 p. 596.

an amount of the chemical naturally reduces the cost of purification, while the ease of handling pleases the engineer.

More than once it has happened that the boilers were heavily incrusted when the use of the fluoride was begun. The old scale was found to loosen rapidly, falling off in some cases by the bucket full. In others it was rotted and softened, so that on the first cleaning it was easily scraped off.

A specimen of highly silicated scale is presented to show how a chemical transformation with the formation of fluoride has resulted from the continued action of small quantities of sodium fluoride added to the feed water. When once thoroughly cleaned to the metal new scale does not form in such instances.

Live steam is so frequently used now in our large manufacturing establishments for cooking, boiling, etc., and so much condensed steam is used to furnish distilled water, especially in artificial ice manufacture, that a method of treating boiler water in such a way as to furnish pure untainted steam is exceedingly desirable. Since sodium fluoride completes its work without rendering the water alkaline, the steam from water thus treated has proved most excellent for such purposes.

It is beyond the province of this article to enter more fully into these details.

Guldlin's Combination Valve Connection for Water Gas Apparatus.

On the 12th inst. U. S. Letters Patent (No. 510,506) were granted to Mr. O. N. Guldlin, of Fort Wayne, Ind., for improvements in combination valve connections for water gas apparatus. Using the words of the specification :

The invention relates to improved means of connection between the generator and superheater of a water gas apparatus and may be regarded as an improvement upon the apparatus shown and described in United States Letters Patent No. 274,637, issued to Frank D. Moses, March

FIG. 1.

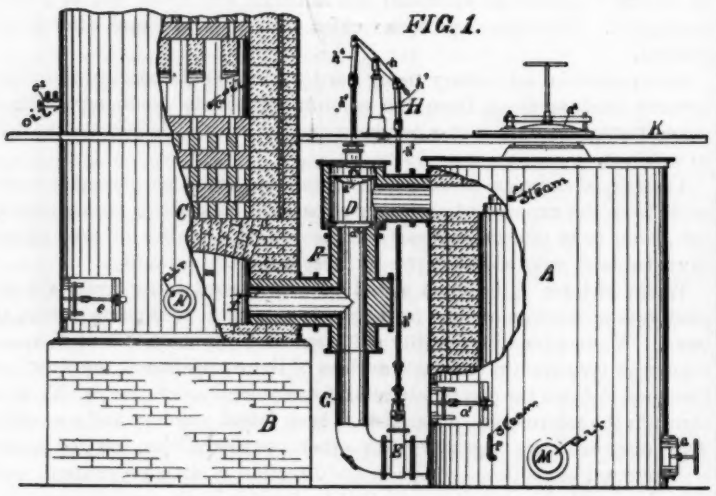
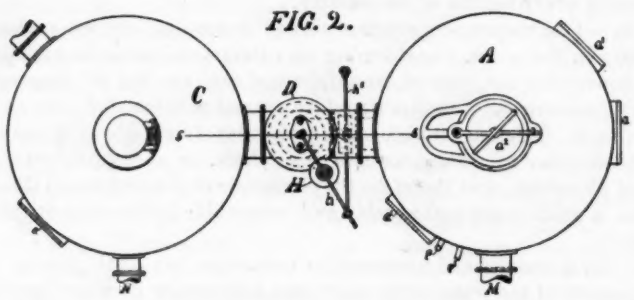


FIG. 2.



27, 1883, for improvements in the "process of manufacturing illuminating and heating gas and the apparatus therefor," though it may be used with any water gas apparatus having the generator and superheater in separate shells.

None of the forms of apparatus now in use for the manufacture of water gas for heating and illuminating purposes, in which the furnace or generator and the superheater are in separate shells, has any means for sending the steam either up or down through the incandescent fuel of the generator, or more properly for making both up and down runs at will.

The object, therefore, of the invention is to provide a combination valve connection for use with the generator and superheater of a water gas apparatus, so constructed and arranged that when in position such a connection may be readily and conveniently established and regulated between the upper and lower part of the generator and the combustion chamber of the superheater that the gases resulting from the passing of steam through the incandescent fuel body, can be passed into the superheater from either above or below the fuel bed of the generator, thus permitting the operator to make up and down runs at pleasure ; and so

FIG. 3.

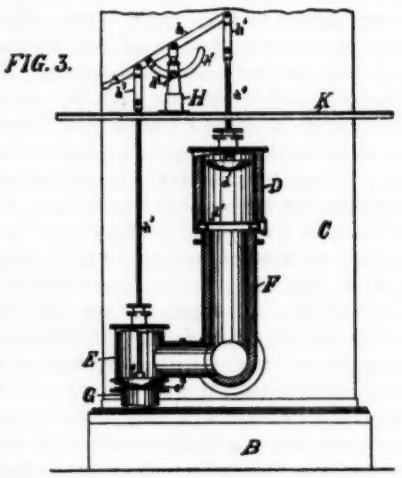


FIG. 4.

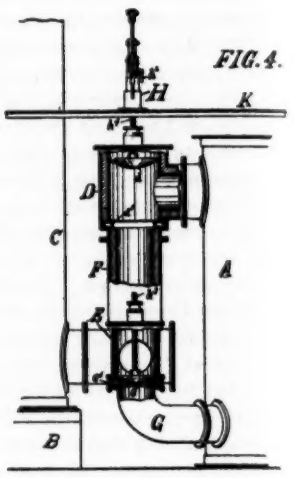
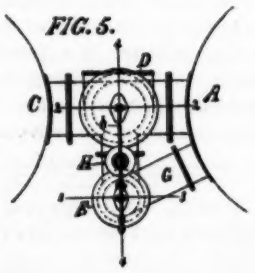


FIG. 5.



arranged that the principal volume of gas may be made by down runs while only an occasional up run is made to break up the clinker and cool the grate, etc., thereby insuring greater fuel economy.

A further object of the invention is to provide a combination valve connection, so balanced as to be promptly and conveniently adjusted, and so arranged that the valves which close said openings from the generator to the superheater, cannot be both closed at the same time, as by my improvement the closing of one valve will automatically open the other, thus insuring the safety of both operator and apparatus at all times.

The invention consists of the novel construction and combinations of the several parts as will be hereinafter set forth and particularly pointed out in the claims.

The object of the invention is accomplished by the mechanism illustrated in the accompanying drawings forming part of this specification in which similar letters of reference indicate corresponding parts in all the views.

Figure 1 is a side elevation of the generator and superheater of the well known Lowe apparatus, in section with my improvement in position therein, only so much of the superheater being shown as is necessary to show the connection of my improvement therewith. Fig. 2 is a plan view of the same. Fig. 3 is a vertical section of the improvement on the line 4—4 of Fig. 5 looking toward the superheater *C*. Fig. 4 is a vertical section of the same on the lines 2—2 and 3—3 of Fig. 5. Fig. 5 is a plan view of Figs. 3 and 4.

Referring now to Fig. 1, *A* is a furnace or primary gas generator of suitable material, properly lined and of well known construction, provided with an opening *M* for blast pipe, an ashpit door a, grate doors a^1, charging doors a^2 and suitable steam pipes p and p^1 above and below the fuel and fire grate, all constructed and arranged in a well known manner.

C is a superheater of any suitable and approved construction, having a proper base *B*, an opening *N* for the blast pipe, a suitable door c, an opening c^1 through which oil may be injected and a suitable injector c^2 for hydrocarbon oils, of which a suitable number may be used at any desired point or points.

The tubular valve chamber *D* of suitable material and properly lined with firebrick or other refractory materials is connected in a proper man-

ner with the generator *A* and also with the superheater *C* by the pipe *F* and branch F^1, which are also suitably lined. A second valve chamber *E*, as seen in Figs. 3 and 4, is also connected with the generator *A* by means of pipe *G* and with the superheater by branch pipe *F*.

Valve chamber *D* is provided with a circular valve seat d^1, preferably of cast iron, seen in Figs. 1, 3 and 4.

The lower valve chamber *E* not being subjected to the same degree of heat as chamber *D*, is preferably not provided with firebrick lining, and the valve seat e^1 for the same reason is simply a ring having its upper and lower surfaces suitably flanged, which give a large exterior surface readily cooled by the air; said valve seat being secured in position by proper bolts as seen in Fig. 4, though the form of valve seat used in chamber *D* may also be used in chamber *E* if desired. The valve seat e^1 may also be readily removed or replaced by removing said bolts.

Upon the operating floor *K* is secured, in any suitable manner, a stand or standard *H*, upon which is properly mounted or pivoted the balanced lever *h*, having a handle for operating the same and a quadrant or circular guide h^1, which plays in a suitable slot in standard *H*, and may be securely locked in any desired position by a lock screw h^2, or other equivalent device, as seen in Fig. 3.

At suitable points on the balanced lever *h* are properly secured the valve rods h^3 and h^4, which pass into valve chambers *E* and *D* respectively, and to the lower ends of which are properly secured the ball or disk valves *e* and *d* respectively. The rods h^3 and h^4 are united to lever *h* by suitable links h^7 and h^6, to facilitate the perpendicular movement of said valve rods.

The valve *d* is preferably a solid metallic ball or disk or other suitable form to stand the heat, and adapted to snugly fit the valve seat d^1 and securely close the opening in the same, but said valve may also be made hollow to permit cooling with water or steam if desirable. Valve *e* may also be constructed as a ball or disk, though for economy of construction, a quick-opening gate valve, of well known construction, connected to valve rod h^3 by its valve lever h^5, or other suitable manner, may be substituted for the ball or disk valve above described.

The operation of the improved combination valve connection for water gas apparatus, above described, is as follows: When it is desirable to blow up a heat the lower valve is closed by lowering the handle of lever *h*. This movement will raise valve *d* and allow a free passage for the blast gases between the upper part of the generator *A* and the combustion chamber *m* of the superheater *C*, as seen in Fig. 1, and the valves are then secured in that position by the lock screw h^2. The same arrangement of valves is made when the steam is admitted below the grate of the generator for an up run through pipe *p* in the usual manner; but when the steam is admitted through pipe p^1 in the generator *A* for a down run, valve *e* is opened by elevating the handle of lever *h*, which movement will at the same time automatically close valve *d*, thus forcing the steam down through the bed of incandescent fuel in the generator *A* and out through the open valve *e*.

The combination valve connection is also applicable to water gas apparatus not requiring any superheater, but where it is desirable to utilize the blast gases for combustion in a vertical boiler or other furnace as well as utilizing the sensible heat of the water gas in a boiler or other heater for absorbing the same. It will thus be seen that by the use of the improvement up and down runs can be made at pleasure; the operation of opening and closing the valves can be made with ease, promptness and safety by means of the balanced lever *h*; no oversight or neglect on the part of the operator can endanger the apparatus by inadvertently closing both valves at the same time; great economy of fuel is secured by closing valve *d* and sending the steam down through the fuel of the generator, instead of deadening the fire by the usual method; and the principal volume of gas can be made by down runs, with only an occasional up run being required to cool the grates and break up the clinkers.

The inventor says he is aware that up and down runs can be made, as above described, in that form of water gas apparatus in which the generator and superheater are inclosed in one shell, but no means have ever been invented, of which he is aware, for connecting the generator and superheater of a water gas apparatus when the same are in separate shells, as in the well known Lowe apparatus, by a combination valve involving the use of two ball or disc valves operated by a balanced hand lever, and an adjustable valve seat which can be readily removed or replaced when desired.

The inventor's claims are:

1. The combination with a gas generating furnace, having steam supply pipes *p* and p^1, respectively at bottom and top, and a superheater having a combustion chamber of gas escape pipes *F* and *G*, connecting respectively at top and bottom of the generator, and with the superheater, and provided with valve casings as *D* and *E*, and balanced valves, as *d* and *e*, rods for said valves, and a centrally pivoted lever pivotally connected at its opposite ends to said rods and located above both valves, so that the weight of one counterbalances the weight of the other, substantially as described.

2. The combination with a gas generating furnace, having steam supply pipes at top and bottom, and a superheater, having a combustion chamber of gas escape pipes *F* and *G*, having valve chambers *D* and *E*, connecting respectively at top and bottom of the generator and with the superheater, and provided with balanced valves as *d* and *e*, rods for said valves, a stand *H*, located above the valves and having pivoted thereto a balanced hand lever, which lever is also pivotally connected at or near its opposite ends to said valve rods, said stand and hand lever also being provided with a quadrant or circular guide, having a locking device, substantially as described.

The Use of Gas Motors in Germany.

We are indebted to Mr. William E. McKay, of Boston, Mass., for a copy of the report presented to the Secretary of State by our Consul-General to Germany, Mr. Frank H. Mason. From it we take the following respecting the use of gas motors in Germany:

Prominent among the economies which have been introduced during recent years in Germany is the use of gas motors in place of steam engines in all the smaller forms of manufacture where the motive force required does not exceed 75 to 100 horse power. At the Frankfort Electrical Exposition of 1891 most of the dynamos were driven by gas and caloric engines, and the display of these motors at that time was almost as varied and interesting to the general public as that of the electrical apparatus to which they were technically subsidiary.

There were in operation at that time throughout Germany about 18,000 gas motors, with an aggregate motive force of 60,000 horse power. Since then the gradual cheapening of gas and the rapid extension of electrical lighting and electrolysis have combined to increase very rapidly the use of gas motors, the effectiveness and economy of which were so brilliantly demonstrated at the Frankfort Exposition. No statistics are available to show the precise number that are at present in use, but, as the two principal makers of gas engines in Germany have alone made and delivered during the past two years 1,950 motors, it may fairly be inferred that the number in actual service in this country is not far short of 24,000 or 25,000.

Meanwhile the progress that has been made in improving the machines and increasing their economy has been quite remarkable. The first gas motors, which were exhibited and used experimentally about 1868, were fatally extravagant. The Lenoir machine, which was the best model known to Germany as late as 1861, used—according to a recent statement in *Kuhlow's Trade Review*—1,235 cubic feet of gas per horse power per hour, whereas the motors now in use consume only 28 feet per horse power per hour in small machines, and in large sizes as low as 23.75 feet; so that 21.2 cubic feet of gas per hour will run an incandescent lamp of 16 candle power, and this proportion is said to have been reduced in large plants which employ motors of 500-horse power and more to 17.6 cubic feet of gas per horse power per hour.

How economical such a motive power must be for all the smaller forms of manufacture, and especially for electrical lighting by isolated plants, will be apparent from the following tabular statement of the price per 1,000 cubic feet of gas which prevails at present in the principal cities of Germany:

Altona, Bremen and Mayence	$1 36
Brefeld (with discount to large consumers)	1 32
Brunswick, Bonn and Strasburg (without discount)	1 21
Magdeburg, Leipsic and Breslau (with discount)	1 21
Barmen (with discount)	1 19
Dantzic and Dresden	1 14
Berlin and Konigsberg (without discount)	1 09
Cassel, Dortmund, Elberfeld and Hanover (with discount)	1 09
Frankfort (with discount)	1 07
Stettin, Essen and Cologne	1 02
Bochum	95

In some of the above-named cities gas is made and furnished by the municipality; in others, by private companies chartered and managed similarly to private gas companies in the United States. In Frankfort the field is occupied by two companies—one English, the other German—which have parallel mains on all principal streets and supply for the above-stated price gas of uniformly excellent quality. When it is remembered that the coal for the manufacture of gas in this city is brought from England and the Ruhr district of Westphalia, it will be apparent that for two rival companies to prosper in a city of 180,000 inhabitants

by selling gas at $1.07 per thousand it must require good management and the employment of the most improved methods. As a matter of fact, the cheapness of gas here, as elsewhere in Germany, is the direct result of the skill and care with which all the subsidiary products of coal distillation—tar, ammonia, etc.—are saved and utilized.

Beal's Gas Scrubber.

On the 12th inst. U. S. Letters Patent (No. 510,396) were granted to Mr. W. R. Beal, of this city, for certain improvements in gas scrubbing machinery, the inventor subsequently assigning his interest therein to Messrs. James R. Floyd & Sons. Using the words of the specification:

This invention relates to the washing or scrubbing of gas, and has special reference to the means employed in a rotary scrubber to secure the maximum of wetted surfaces within said scrubber, and their easy removal for cleansing purposes.

Fig 1

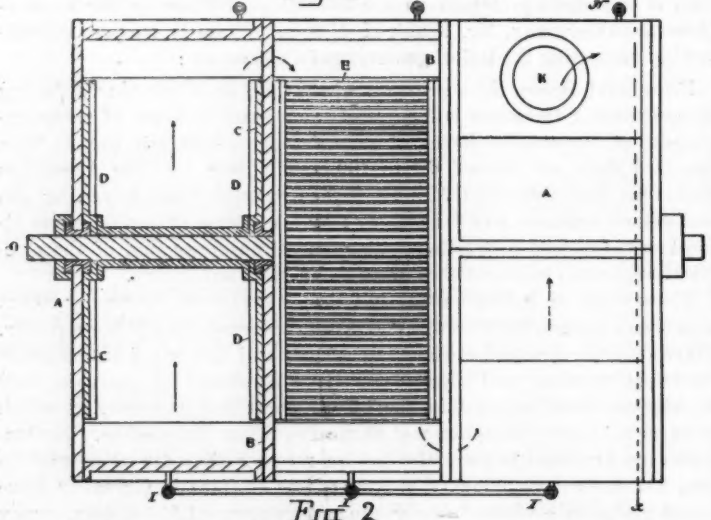
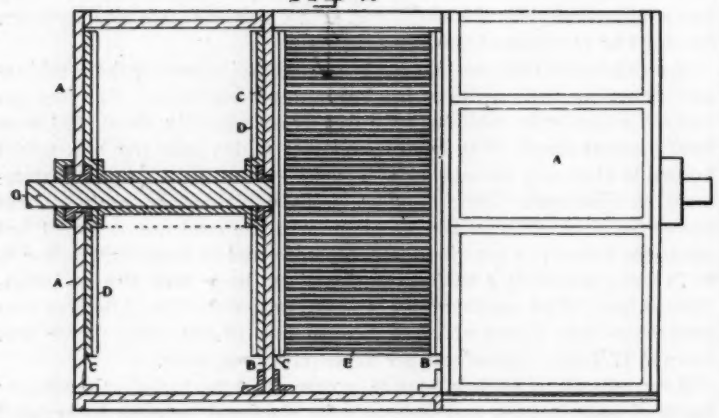


Fig 2



While the primary object of a gas scrubber is the elimination of the ammoniacal properties in crude gas, it is well known that certain tarry elements are also deposited during this process of purification, and that their presence requires frequent cleansing of the scrubber to prevent its clogging from this cause. It is therefore highly essential in the construction of a gas scrubber that, in providing for extensive wetted surfaces against which the gas is brought into frictional contact in its passage through the apparatus, provision should also be made for the prompt removal, through cleansing and expeditious replacement of said surfaces when any excess of tar is found deposited thereon. Besides accomplishing these desiderata in a most effectual manner, I do so by an exceedingly simple device, which consists in providing each compartment of the apparatus with two circular plates mounted upon a common shaft, the plates having radial flanges forming segmental divisions thereon. I fill these divisions with rods transversely and loosely laid between the circular plates, the rods being separated from each other by rings fitted over the rods at each end thereof, thus affording ample space between them for the passage of gas. When in service these plates and rods are continually wetted by the rotary movement of the plates through water in the lower part of the compartment. As the compartments open into each other above the water line, the gas traverses the entire series through the rotary plates and rods therein. By having one of the plates of the main shell, in each compartment, removable, the rods can be easily taken out and replaced by others.

In the accompanying drawings Fig. 1 represents a plan view of a scrubber, partly in section, provided with the invention. Fig. 2 is a side elevation, partly in section. Fig. 3 is a sectional end elevation, taken on the line x—x, Fig. 1. Fig. 4 represents one of the circular plates divided into segmental divisions by the radial flanges thereon, with the rods in position in one of said divisions. Fig. 5 is a plan view of one of the segmental divisions and the rods held in position therein. Fig. 6 is a perspective view of the rods, showing the collars thereon. Fig. 7 represents two forms of collars which may be fitted on the rods. In the drawings like letters refer to like parts.

A is the outer shell of the main chamber of the scrubber, and *B B* the partitions forming the compartments therein. *C C* are the circular plates, mounted upon shaft *G*. *D D* are the radial flanges which form segmental divisions on said plates. The rods *E*, having collars *F* thereon, are loosely laid between the circular plates, until each of the segmental divisions is filled with the rods. The rods are held in place by strips or bands *L*, shown in Figs. 4 and 5, said bands being secured at their ends by bolts through the flanges *D*. The rings or collars *F* are preferably of cast metal, but may be made of any suitable material, the *F* shown in Figs. 6 and 7, being of heavy wire formed in one or more coils. Disks of wood, paper or metal may also be secured to the ends of the rods—in lieu of the rings shown—the object of these being to keep the rods sufficiently separated from each other, so as to allow a free passage for the gas passing through the scrubber.

Fig 3

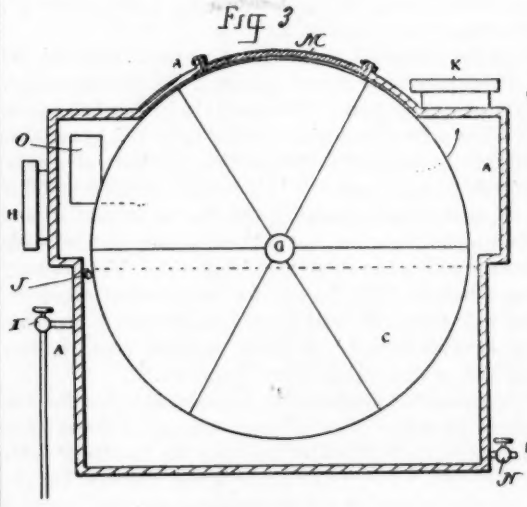


Fig 6

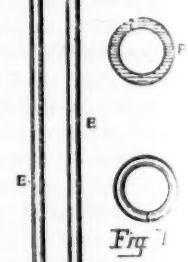


Fig 7

Fig 4

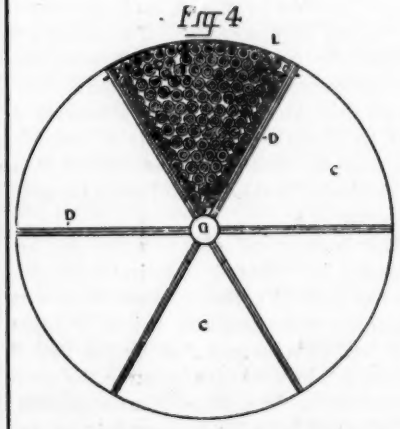
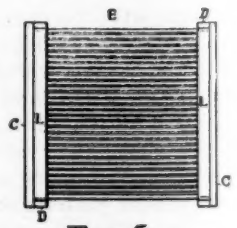


Fig 5



The partitions *B*, which form the compartments, reach from the base to the top of the scrubber, the lower part of each compartment below the dotted lines shown in Figs. 2 and 3 being filled with water through supply pipes *I*, the water being admitted into the last compartment of the series, and by overflow passages *J* fed to the other compartments, the first compartment being understood as the one into which the gas first enters, through pipe *H*.

N are discharge pipes for the water. Above the shaft *G* the partitions are provided with openings *O* (Fig. 3), with area equal, at least, to the inlet pipe *H*. These openings are so arranged at the opposite ends of each compartment that a serpentine movement, indicated by the arrows in Fig. 1, is imparted to the gas on its passage through the scrubber to the discharge pipe *K*.

To provide for the cleaning of the scrubber at any time when the rods become covered with an excess of tar, a plate *M* (Fig. 3) in the shell of the main chamber, above the shaft on each compartment, may be made removable. Through this the rods can be readily taken out and immediately replaced by clean ones.

The inventor's claim is: A washer for gas scrubbing apparatus comprising a shaft *G* having two plates or disks *C C* secured transversely and separated thereon, ribs or flanges *D* on said plates, the flanges on each plate similarly arranged so as to form pockets or receptacles for rods *E*, the said rods constructed to fit laterally removable between the plates and within the flanges, and having separate or individual collars *F*, and the removable strip or band *L* for holding the rods in the pockets, substantially as shown and described.

Recent Progress in the Manufacture of Steel Castings.

By Mr. H. L. Gantt, Elizabeth, N. J.

When I spoke of the condition of the art a few years ago, probably but few realized how very few years were really meant. The first soft steel castings, such as are used for gun carriages, that were made in this country, and which were subjected to a ballistic test, were made in 1886 and 1887 by the Midvale Steel Company, who were the pioneers in this work. The ballistic test was considered severe at that time; but to day the ordinary soft castings made by almost any one of a dozen of the best steel casting companies would pass it successfully.

Though it was about 1886 or 1887 before any large increase took place in the use of steel castings, they had been successfully made in this country at least as early as 1867. In July of that year, the Wm. Butcher Steel Works, now the Midvale Steel Works, cast some crossing frogs for the Philadelphia and Reading Railroad, of crucible steel. The molds were made of ground fire brick, black lead crucible pots ground fine, and fire clay, and washed with a black lead wash. The surface of these castings was very smooth, and the metal, which was practically tool steel, was so well adapted for the purpose that some of the castings made in those early days are said to be still in use.

This was before the use of silicon for solidifying steel was known, and the castings were very much honeycombed in all parts except the wearing surface of the frogs, which was "cast down." The possibility of getting one face of a casting approximately solid admitted of the use of steel also for hammer dies, although their general sponginess was a great obstacle to their extensive adoption.

On April 28, 1876, two small hammer dies were made of open hearth steel at the same place, and on May 29 a hammer head weighing 2,535 pounds was made. As long as castings were small, the molding mixture of ground brick, ground pots and fireclay was satisfactory, but on large castings made with that facing the surface was very imperfect, and the sand adhered to it with great tenacity. But little improvement in the method of molding was made for some time, and while the quality of the steel was gradually improved, the appearance of the castings was decidedly against them, and but little progress was made in their introduction.

The next step taken by the Midvale Steel Company was to leave the ground pots out of the molding mixture, and to wash the mold with finely ground clay firebrick. This was a great step in advance, especially in heavy castings, and a marked improvement took place in their general appearance, but the mixture still clung so strongly to the casting that only comparatively simple shapes could be made with certainty. A mold made of such a mixture became almost as hard as firebrick when dried, and offered so much resistance to the proper shrinking of castings that, when at all complicated in shape, they had so great a tendency to crack that their successful manufacture was almost impossible. The next step was to use a mixture of silica sand and flour. In small castings this gave pretty good results, as such a facing cleaned off the casting very readily, leaving a smooth surface much superior in appearance to that left by the ground brick. The great difficulty in the way of the extended use of such a facing was the tendency of the flour to burn in drying, leaving the sand without a proper bond, and often the burnt mold was so friable as to be entirely useless. In the case of large castings it was almost impossible to dry thoroughly the whole mold without burning that portion nearest the fire, and for such work flour was necessarily abandoned.

By this time the use of silicon for solidifying castings was becoming general, and the only obstacle in the way of making good steel castings was the want of a suitable molding sand. This was ultimately found in a mixture the principal constituents of which were silica sand and molasses thoroughly ground together.

The improvement in the appearance of castings caused by the use of a sand that left a clean, smooth skin was the cause of their rapid adoption; and the year 1887, when the Midvale Steel Company made the first gun carriage castings of steel, is appropriately the date at which their rapid extension began.

At this time the necessity for hot metal did not seem to be understood, and castings frequently contained blowholes, when it seemed that all the conditions for making them perfect had been complied with. It was noted before a great while that small castings contained more holes than large ones, and that those poured last on a heat were worse than those poured first. The conclusions that hot metal was needed to make solid castings, and that smaller castings needed hotter metal than large ones, were soon deduced and amply verified. Apart from these considerations, the superior appearance of castings made from hot metal was sufficient to cause all steel casting makers to work in that direction. The difficulties in the way of getting uniformly hot metal are hard to overcome in an open hearth furnace. The delay caused by a slow or difficult tap of the furnace, which is always liable to occur, is fatal to the production of the best castings. Besides what has already been mentioned, cold metal in the ladle is to day the cause of more complaints by purchasers and expense to the manufacturer than anything else in connection with the manufacture of steel castings. I will enumerate a few of the troubles that may be traced directly to this cause. What is known as a "bad shut off," or a leaky stopper is usually caused by a small amount of metal chilling in the nozzle and preventing the stopper from going to its place. In cases where the dribble is slight, the worst effect is that a small amount of metal runs into the mold while the ladle is being gotten over the runner. This metal is apt to chill, and make a bad looking spot on the casting, or, in the case of small castings, block up the runner entirely, and cause the loss of the mold. When the leak is very bad it not infrequently happens, especially when the heat is a large one, composed principally of small castings, that the flasks are covered by the molten steel and so strongly fastened together that it is almost impossible to separate them from the steel without considerable loss by breakage.

Again, by a careful study of the subject, I feel that I have been able to lay to the door of cold metal one of the most fertile sources of complaint which steel founders have met with—namely, lack of homogeneity, which includes both hard spots and loose places. I use the term "loose" rather than spongy, for the reason that I do not so much mean a cluster of holes as a spot where the metal simply seems less dense. Such places, without any visible continuous hole, or even without anything that would indicate the existence of such a hole, allow leaks in hydraulic cylinders, and cause the failure of a test bar.

When we consider more in detail the process of making open hearth steel castings, we see why these defects are more apt to occur in cold than hot metal. While the metal is being tapped from the furnace, the silico-spiegel necessary to prevent blow holes is generally thrown into the ladle, usually in the solid, though heated, state. If the metal is very hot, and consequently thoroughly fluid, the silico spiegel is dissolved at once and uniformly disseminated through the mass. If, however, the metal should not be so hot, it is easily seen that the silico-spiegel may not become at all thoroughly diffused, and the slightly viscous metal in the ladle may be the reverse of homogeneous, in which case the resulting castings may be very far from what is hoped for. It is now the practice in the best foundries to melt the silico-spiegel, and these defects in their worse form are thus practically eliminated.

Why hard spots should appear in cold metal is readily seen, for lumps of partially melted silico-spiegel would certainly form the nuclei for such spots; but why the loose places should occur is not quite so apparent. It may be noted that the loose places appear to a more marked extent in large masses than in small ones, and the most reasonable explanation seems to be that the silico-spiegel, which is but imperfectly melted when the metal is poured, finally melts thoroughly after the metal is in the mold, which can only occur in very heavy castings, forming a spot higher in carbon, manganese and silicon than the metal surrounding it. Such a spot would have a lower melting temperature than the adjacent metal and would remain partially fluid after the other metal was set. The result of such a condition would be to drain away a portion of the fluid metal to feed the shrinkage in the metal solidifying about it, leaving a more or less spongy spot.

That shrinkage holes and cracks do still occur in steel castings is well known, but the success that founders have had in casting complicated shapes within the past year or two has been surprising. The fact that a steel casting must cool at the bottom first, and then gradually upward in the mold, is being learned by designers; and shrinkage holes are becoming less frequent, for the founder at once fixes on the heaviest

portion for his sink head, which is usually about 20 per cent. of the total weight of the casting, and which must remain fluid until the whole of the casting proper is solid.

By a strict observance of the rule that a steel casting should, as far as possible, be of uniform thickness throughout, it has been possible to make within the past few years castings 20 feet long by 10 feet wide, which would have been considered impossible a few years ago. To one unfamiliar with the details of the process of making steel castings, the statement that to-day we can get large steel castings that are perfectly satisfactory, while it is almost impossible to get good small ones, would seem very strange. It is, however, a fact, and the explanation is simple. Most steel castings are made by the open hearth process, and the furnace usually melts from 5 to 20 tons. To pour even 5 tons of steel into castings averaging 100 pounds in weight would, as a rule, take so long that those poured last would be of inferior quality on account of the cooling of the metal. As a rule, a large portion of the heat is poured into a comparatively few large castings, and the remainder put into the smaller ones. If the metal is very hot to start with this way may give fair results, but in all cases the least desirable metal is put into the small castings.

This difficulty seems almost insurmountable by the open hearth process, but is readily overcome by a small Bessemer converter, from which we can get two or three tons of metal as hot as we may wish it. Add to this the fact that we can get from the converter that quantity of metal of any composition we may desire every half hour throughout the day, and we realize the advantage of the Bessemer process for making small and medium weight castings. The manufacturers of electric motors who have been buying their castings from open hearth foundries have apparently not realized what the Bessemer foundry has in store for them. It seems hard to believe that perfectly solid steel castings can be made of the following composition with regularity: Carbon, 0.12 per cent.; manganese, 0.30 per cent.; silicon, 0.30 per cent., but it is a fact. It may be noted, however, that this steel, while very well adapted to electrical purposes, is of but little value for any miscellaneous castings, except very small ones, on account of the tendency it shows to crack during the process of solidifying, when cast in shapes at all complicated.

The fact that we can make a number of different kinds of steel each day if we use a converter, and but two or three heats at the most in 24 hours if we use an open hearth furnace, gives a great advantage to the founder using the converter, especially if he is making all kinds of steel castings, enabling him, as a rule, to make far more prompt deliveries than is possible for the open hearth founder doing the same variety of work.

Among the other advances made in casting steel may be mentioned one for making a casting having one or more faces of a steel much harder than the body of the casting. The process consists in lining such faces of the mold as will be adjacent to the parts of the casting it is desired to harden with a metallic alloy in a crushed or powdered state, capable of being melted and absorbed by the molten steel in contact with it, and of such a nature as to impart to the steel a hard face, or a face of such a composition as may be readily hardened. If it is desired that the casting shall have a permanently hard face and be used for stamp shoes, crusher jaws, hammer dies, etc., ferro-manganese gives the best results. If it is desired to do machine work on the face, and make it extremely hard afterward, ferro chrome is most suitable. The fact that it is possible to produce a soft steel casting having a face that can be hardened without causing the remainder of the casting to become brittle will undoubtedly make it possible to use steel castings in place of chilled iron in many places with great advantage.

The Luhrig Coal Washing Plant.

At the September meeting of the British Iron and Steel Institute, James l'Anson, of Darlington, read a paper describing the Luhrig coal washing and dry separation plant which was then in process of construction at a pit of the North Bitchburn Coal Company, Evenwood. This plant is to handle 1,000 tons of coal per day as drawn from the pit. It has two drawing shafts from which the coal as it comes to bank is run into tipplers of improved construction, whence it is delivered by means of short traveling bands on to the shaking screens, of which there are three, inclined at a somewhat low angle. These screens are formed of plates pierced with round holes, which insures a more uniform sizing than where bar screens are employed. Any desired size of mesh can be used by putting a suitable plate into the screen. Usually holes of about 2½ inches diameter are employed.

All the coal which passes over these screens falls on traveling belts, upon which it is hand picked. Two of these belts are formed of bars carried by links, so that any small coal resulting from the cleaning process falls through the spaces between the bars on to flat sheets, whence it is carried by scrapers, placed transversely to the line of the belt back on to a transverse traveling belt, delivering it into a large hopper, which also receives the whole of the coal passing through the screens. The third belt is formed of close plates instead of bars, in order that it may be used for dealing with unscreened coal if required, in which case a blind plate is put into the corresponding screen in place of the perforated one.

At the end of each belt is a loading arm, round which the belt passes. This can be lowered into the empty truck which is to be filled by means of hydraulic power, and gradually raised as the truck fills, thus saving any appreciable drop and consequent breakage of the coal.

The coal passing through the screens falls on to a traveling belt formed of plates in the trough form, by which it is delivered into a large hopper situated just outside the washery building and below rail level. A second belt, parallel to the first, delivers into trucks, so that the coal passing through the screens can be automatically loaded at once, should it be desired to send it away unwashed. Provision is also made for separating nuts of any required size, by putting a second plat in the screen, which can be delivered on to the second traveling belt, to be loaded unwashed if desired.

All the coal which goes into the large hopper is taken by an elevator to the top of the washery building and delivered into a sizing drum or revolving screen, where it is sorted into nuts 2½ inches to 1½ inches, 1½ inches to 1 inch, and 1 inch to ⅝ inch diameter (these being the sizes of the round holes in the shells of the sizing drum), and small from ⅝ inch downwards. Each size of nut then falls down its appropriate shoot into its own washing box. These washing boxes are formed of wood lined with plate, and are divided longitudinally into two sections by a partition not quite reaching to the bottom. In the front compartment of the box is a sieve on to which the nuts are delivered, and here they are met by the washing water, forced to the top of the building by a centrifugal pump.

Near the top and to the front of the box is a longitudinal opening, out of which the water flows, carrying the washed coal, whilst lower down and just above the level of the sieve is another opening for the escape of the refuse. At the bottom of the box, which is hopper shaped, is a valve which can be opened when required to let out any fine refuse which has passed through the sieve. The back compartment of the box is fitted with a wooden piston, actuated by an eccentric of appropriate throw, upon a line of shafting, the stroke of the piston being proportioned to the size of the material under treatment.

The washed coal passes from the front and top of the box into a draining shoot, to which a vibrating action is given to separate the water more effectually, and from the draining shoot the nuts are delivered into loading hoppers, under which trucks are run and loaded through a sliding door in the bottom of the hopper.

The refuse, to some of which a certain amount of coal is adherent, is delivered from its proper exit into a conveyer, whence it is taken to a pair of crushing rollers in order to separate the adherent or intergrown coal.

From this point it is taken by an elevator to a sizing drum, graded into two sizes, and delivered into two re-washing boxes, in which the coal is recovered and can be disposed of as required.

The small coal delivered from the large sizing drum in sizes of ⅝ths and downwards, meets the used washing water from the nut boxes, by which it is conveyed into a grading box situated behind the small coal washing boxes.

Each section of the grading box delivers its own size of coal into a washing box similar in construction to the nut washing boxes, but having a layer of feldspar crystals resting upon the sieve. The necessary impulse is given to water by pistons similar to those already described, but of shorter stroke, proportioned to the fineness of the coal to be treated. This bed of feldspar is an important factor in the washing of fine coal, opening and closing with the impulse of the water, and permitting the heavier dirt to pass through while the coal is suspended above.

The washed fine coal passes out of the front of the boxes, as already described in the case of the nuts. The dirt passes through the feldspar and is delivered from the bottom of the boxes, after which it mixes with the product from the crushing rollers, and is re-washed with it in the special boxes already described.

The washed small coal passes from the washers into a draining drum of $\frac{1}{32}$ in. mesh, all the coal above this size being subsequently taken by an elevator into storage hoppers for delivery to the coke ovens or else-

where. The effluent water, with all the finest coal below $\frac{1}{32}$, passes into the sludge recovery.

The sludge recovery consists of a long chamber under the building, with a cemented floor, on which the fine sludge is allowed to settle. In this chamber is a slowly moving belt with cross scrapers, which scrape the sludge off the bottom, and deliver it into a large hopper at the end of the chamber, whence it is taken by an elevator, and can be either mixed with the small coal in the same storage hopper or kept separate as required.

The degree of efficiency secured by a plant such as is described above may be gauged by the guarantees given by the Luhrig Company in the case of the one erected at Motherwell, and which has been fully borne out in practice. These guarantees are as follows: Capacity of plant, 1,500 tons per day of 10 hours, on the basis of the coal containing 23 per cent. of ash. Ash contained in washed coal of $\frac{6}{16}$ to $\frac{1}{32}$ not to exceed 6 per cent. The rubbish or dirt which has been washed out is guaranteed not to contain more than 2 per cent. of fine coal. The cost of labor is guaranteed not to exceed $\frac{8}{16}$ths of a penny per ton of coal handled, including labor in hand picking, sorting, washing, and loading into trucks. In practice, it is found that the ash does not exceed 2½ per cent., the coal in the dirt 1 per cent., and the labor ½d. per ton.

An Interesting Decision in Respect to the Repairing of Incandescent Electric Lamps.

Judge Colt, in the U. S. Circuit Court of the Massachusetts District, recently delivered the following opinion in the case (No. 3196), entitled the Edison Electric Light Company, et al., vs. Davis Electrical Works, et al.:

If the Edison lamp were so constructed that a new burner could be placed in it like a new wick in an ordinary lamp, or if it were made of two parts designed to be taken apart for the purpose of replacing the old burner with a new one, as in the Sawyer-Man lamp, I should hold that a purchaser of the Edison lamp had a right to renew the carbon filament on the ground that this was an ordinary repair contemplated by the patentee when the lamp was sold, and that the defendant in so repairing such lamps did not infringe the Edison patent.

But the difficulty which meets me in this case is that the Edison lamp was not designed to be so repaired and is incapable of such renewal.

The Edison lamp is constructed as an organic whole, and you cannot break open the all glass chamber and insert a new filament without a substantial reconstruction of the lamp. The lamp is only intended for use during the life of the filament. In prior incandescent lamps, the life of the burner was brief, and it was necessary to so build the lamp that this part could be renewed. Edison, by making an almost perfect vacuum in the all-glass chamber, and thoroughly sealing all the parts, constructed a lamp in which the filament or burner lasts from 600 to 1,000 hours. To attain this result the lamp assumes a form of construction which renders it impossible to replace a new filament in the glass bulb without building essentially a new lamp.

When you take an Edison lamp with its filament destroyed and break open the all-glass chamber you have only left the broken pieces—the remains—of the original lamp. Its identity as a structure is gone. The only parts remaining which are not impaired or destroyed are the metallic head and the leading-in wires. When you build anew from such materials it is like breaking up an old machine and constructing a new one in which some of the old parts are used.

The defendants first break off the tip of the glass bulb of the lamp and ream out a hole almost one-half inch in diameter. The new filament, having its ends cemented into platinum sleeves, is then inserted into the glass chamber, the sleeves being pushed down over the two platinum leading-in wires, and compressed upon them. A tube of glass made in the shape of a funnel is heated and placed over the hole in the lamp chamber. This tube is fused into the open end of the bulb, which brings it into the condition of the ordinary lamp bulb just prior to exhaustion. The air is then exhausted and the bulb sealed.

It is evident that this operation covers many of the constructive features of the ordinary lamp.

When we consider what is done by defendants in connection with the second claim of the Edison patent, it is made clear, I think, that the defendants do more than merely repair.

The claim is for: "The combination of carbon filaments with a receiver made entirely of glass and conductors passing through the glass, and from which receiver the air is exhausted for the purpose set forth."

It will be seen that this claim consists of four elements—a carbon filament, a receiver made entirely of glass, conductors passing through the glass, and a receiver from which the air is exhausted.

It is apparent that defendants by substituting a new filament, making over the glass receiver, and exhausting the air from such receiver, produce a lamp in which all the elements but one (the leading-in wires) of the patented combination are used, either in a new or reconstructed form.

The lamp thus produced is substantially a new lamp, and its voltage may be higher or lower than the old one. From the very nature of the Edison invention, I do not see how the glass bulb can be opened and a new filament inserted without making essentially a new lamp.

As to the new lamps which the defendants are charged with making, I find no sufficient proof that the defendants made, or threatened to make them, since the decision of the court sustaining the Edison patent. Their business seems to have been confined strictly to their so-called repairing. Injunction granted.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE new management of the Brooklyn Fire Brick Works is of the progressive sort, and the commodious and complete plant on Van Dyke and Elizabeth streets, Brooklyn, is taking on the busy hum that characterized it in the palmy days of the early seventies. The President, Mr. Gutkes, is a sensible business man, who believes in looking for trade as well as accepting that which comes to the office in the ordinary way; and his lieutenants, Messrs. Morgan and Russell, are also of the active type. Among the contracts recently booked by the Company was one with the Consolidated Gas Company, of this city, under which the latter will take all the retorts, fire brick, tiles, shapes, etc., needed by it during the year 1894.

THE proprietors of the Atlantic City (N. J.) Gas and Water Company have determined to put in an incandescent electric lighting plant. The electric company now doing business there operates a plant of the Edison type.

WE are indebted to "L. C. H." for the following local items from Norwalk, Conn.: "The Supreme Court has reversed the decision of the lower court in the case of the Norwalk Gas Light Company vs. the Borough of Norwalk, and ordered a new trial. The action was brought to recover damages to the gas mains during the building of the public sewers. In the Superior Court the case was decided against the Gas Company, who lodged an appeal to the Supreme Court, with the result above noted.——The home of James Sutherland, on Baldwin avenue, narrowly escaped destruction by fire at about noon of the 15th instant, and the cause was rather peculiar. The electric street railroad passes the premises, and it appears that the return current, some of which escapes from the rails into the ground, followed an iron water pipe into Mr. Sutherland's cellar, switched off on to a gas pipe at a point where the two were in contact, and followed the latter to the meter where it melted the lead connection and ignited the gas. The flames had communicated to the floor timbers when they were discovered, but a thoughtful neighbor turned off the gas and the fire was extinguished without the aid of the firemen, who were promptly on hand in response to an alarm from Box 21. The cause of the fire was discovered by accident. One of the firemen happened to touch the water pipe with a piece of metal, whereupon there was an electric display that startled the entire party and revealed the cause of what would otherwise have been a mysterious fire."

THE United Gas Improvement Company have about decided to erect a handsome office building for their Paterson, N. J., branch. The site selected is at the corner of New Colt and Ellison street, and the work of construction will be begun next spring.

JUDGE ARNOLD, of Court No. 4, Philadelphia, last Monday handed down an injunction continuing until further orders of the Court the injunction granted in the case of the West Manayunk Gas Light Company against Receiver of Taxes John Taylor and the city of Philadelphia. The litigation was begun last May by the Gas Company filing a bill in equity, claiming that it should be exempted from taxation upon certain of its property used for the purposes of its business, against which defendants assessed taxes.

THE interest on the first mortgage bonds of the Saratoga (N. Y.) Gas and Electric Light Company having defaulted, and a foreclosure suit having been commenced, Charles S. Fairchild, of the New York Security and Trust Company; Frederick D. Tappan, of the Gallatin (N. Y.) National Bank; W. A. Smith, of W. Alexander Smith & Co.; William Edward Coffin, of Coffin & Stanton, and Newman Erb, have been constituted a committee by a majority of the bondholders to protect holders

and reorganize the Company, if necessary. Bondholders are invited to deposit their bonds with the New York Security and Trust Company, the depository appointed, on or before January 2, 1894. Transferable certificates of receipt will be issued.

It is reported that the coal fields north of Ukiah, in Mendocino county, Cal., are soon to be developed. Years ago arrangements were made by Messrs. Mackay, Flood and Floyd to open up the mines, but litigation brought matters to a close. Recently all the land came into the possession of Messrs. Mackay and Flood, and now it is stated the coal has been tested, found to be first-class, and work may begin in the near future. The coal has been pronounced within 3 per cent. as good as the Wellington, and it is said it can be laid down in San Francisco at about $3 per ton.

The Gas Commission of this city, Mayor Gilroy presiding, awarded the following contracts for the public lighting of New York, for one year from January 1st, on the 15th inst.:

Gas Lights.

Company.	No. Lamps.	Price per Annum, Each.
Consolidated Gas Company.....	1,397	$17 50
Equitable Gas Company.....	3,995	12 00
Standard Gas Light Company.....	2,565	13 04½
Central Gas Company.	1,121	24 00
Northern Gas Company	2,200	28 00
Yonkers Gas Company	642	28 00
N. Y. & N. J. Globe Co. (naphtha)..	152	22 00

Electric Lights.

Company.	No. Lamps.	Price per Night.
Brush Electric Company.....	237	40 cents.
" " "	90	45 "
United States Company.....	382	40 "
Mount Morris Company	339	40 "
Harlem Company.....	210	40 "
Manhattan Company.....	150	40 "
North River Company.....	800	45 "
Edison Company.....	105	50 "

The matter of the dissolution of the Elmira Illuminating Company and the Elmira Gas and Illuminating Company came up again on the 14th inst., before Referee Miller, of Bath, N. Y., at the office of Judge S. S. Taylor in the Elmira Court House. Owing to the illness of Mr. Frederick Cheney, a material witness for the Companies, the matter was adjourned until Feb. 23, at 10 o'clock A.M.

The proprietors of the Consumers Gas Company, of Montreal, have closed a contract for a second set of water gas apparatus, with the Economical Gas Apparatus Construction Company, Limited, of Toronto. The results obtained so far from the set of the Merrifield-Westcott-Pearson apparatus recently started up at Belleville, Canada—this set replaced a set of the Springer type—have exceeded the claims of the builders, wherefore, it is needless to add, the Belleville gas proprietors are greatly pleased.

The following extraordinary ordinance was recently introduced in the Common Council of San Jose, Cal., by Councilman Hogan, and the same was very sensibly referred to the City Attorney, who was instructed to file a written opinion as to the legality of the proposed action. We have no doubt that the Attorney will decide that the ordinance is altogether outside of reason. In the meantime Councilman Hogan said his reason for introducing the ordinance was simply to carry out the law which he asserted provides that municipal bodies may fix the gas rates:

"*Resolved*, That the San Jose Light and Power Company be and is hereby required to furnish, on or before the 8th day of January, 1894, to the Mayor and Common Council of the city of San Jose, a detailed statement, verified by the oath of the President and Secretary of the corporation, showing the name and residence of each gas ratepayer, and the amount paid by each such gas ratepayer during the year 1893; and also showing all revenue derived from all sources and an itemized statement of expenditures for supplying gas during said year, and that accompanying said statement said corporation shall also furnish a detailed and verified statement showing the amount of money actually expended annually since commencing business in the purchase, construction and maintenance respectively of the property necessary to the carrying on its gas business; and also the gross cash receipts annually for the same period from all sources."

The Chelsea (Mass.) Gas Light Company has petitioned the Board of Gas and Electric Light Commissioners for a rehearing on the question of a reduction in the price of gas and to be allowed the same rights relative to a discount for prompt payment of bills as those enjoyed by other Companies of the State. The Company declares that the reduction recommended by the Commission in the price of gas at Chelsea will cut the receipts to a point where the annual dividend will amount to only 4 per cent.; further, that no increase in output is likely to follow the reduction.

The proprietors of the Woodstock (Vt.) Gas Company have decided to discontinue the manufacture of a high candle power oil gas. They propose to put in a water gas plant, and cut the rate per 1,000 cubic feet to $2.50. The current rate is $7 per 1,000.

The contract for the erection of the municipal electric lighting plant for Little Rock, Ark., has been awarded. The apparatus proper will be supplied by the Fort Wayne Electric Company, at its bid of $26,650, and the building will be constructed by A. M. Bailey, who agreed to do the work for $3,225. The total amount appropriated by the authorities for the plant complete was $30,000.

Mr. John G. Fry has been appointed an Auditor in the Philadelphia Gas Bureau, vice Mr. Jas. Rowley.

The proprietors of the Municipal Gas Company, of Albany, N. Y., have notified the consumers that hereafter the gas rate is to be $1.70 per 1,000 cubic feet, a concession of 30 cents per 1,000, the concession to take effect from the 1st inst. Secretary and Treasurer McElroy, in speaking of the reduction, said: "A meeting was held the last week in November, at which Mr. E. C. Benedict, of New York, one of the principal stockholders, Governor Flower, Robert C. Pruyn, J. Howard King, President A. N. Brady and most of the Directors were present. It was then discussed and decided upon to reduce the price at which the Company furnishes gas to Albanians, and it was finally agreed upon that the rate after December 1st should be $1.70 per 1,000 cubic feet. The quarter's gas bills are sent out on that date, and are collected between that time and the middle of the month, and it was thought that if consumers learned of the reduction there would be many arguments by those paying later in the month, resulting from the confusion of the date of changing the price. It was, therefore, decided to make the announcement after most of the people had paid, and the benefits would be the same to our customers, whether they knew it or not." The Secretary also intimated that indications were pointing to a further reduction in the rate, and we hope this is so. In fact, we are somewhat disappointed over the knowledge that the rate was not put at $1.50 per 1,000, for the $1.70 figure has much the appearance of a makeshift.

Mr. John Colly Abbott, who served the Brookline (Mass.) Gas Company for many years in the earlier history of that corporation, died at his home in Boston some days ago. Deceased, who was in his 83d year, was born in Concord, N. H., and shortly before attaining his majority formed a partnership with George Hood, under which they represented the shoe manufacturing concern of Nathan Breed (his shops were located in Lynn, Mass.), at St. Louis, Mo.—it is worthy of note that at the formation of this agency the population of St. Louis was less than 10,000. In 1848 Mr. Abbott returned to the East, making his permanent residence in Brookline, where he soon became prominent in business and political circles. The funeral services were held at King's Chapel, Boston.

The following is said by the public prints to be the way in which that famous $4,500,000 note has been cancelled by the Bay State Gas Company: "The Directors of the Bay State Gas Company have finally made public their disposition of the much-discussed $4,500,000 construction note, which represented watered stock and which an act passed by the Legislature required to be retired. There are three stages to the exchange which its cancellation made necessary. The note was the property of the Bay State Gas Company, of Delaware. Prior to its cancellation, however, it was sold to the Bay State Gas Company, of New Jersey, for $1,300,000 in new Boston United Gas Firsts, 5 per cent. bonds. This New Jersey Company had authority to increase its bonds on stocks already deposited to $12,000,000, and prior to this transaction only $10,000,000 had been put out. The Bay State Gas Company, of Massachusetts, then, as permitted by the Court through the provisions of the enactment, increased its capital stock from $500,000 to $2,000,000. The New Jersey corporation then cancelled the note which it had purchased, and in return the Massachusetts corporation deposited the new stock with the Mercantile Trust Company, of New York, to secure the bonds

of the New Jersey corporation. Furthermore, the New Jersey corporation issued to the Delaware Company $700,000 more new first 5 per cent. bonds for improvements in the gas properties of the syndicate, expert examination showing that $1,400,000 had been expended on the plants, and that $700,000 permanent value had been added to them. The Delaware Company does not propose to list the $1,300,000 5 per cent. bonds received for the construction note, but to keep them as permanent assets. The $700,000 bonds received for improvements, all of which except $50,000 is owned by the Delaware Company, will be listed."

THE United Labor League, of Philadelphia, has adopted a resolution and presented the same to the authorities of the city, protesting against the passage of the ordinance providing for the sale of the municipal gas works. The resolution recites the fact that the large sum which has been offered for the plant should be taken as sufficient evidence why it should be retained and operated by the city on public account.

THE Laclede Gas Light Company, of St. Louis, has permitted the city to use its lamp posts as rests for sign boards indicating the names of the streets, agreeing to make no charge therefor.

THE Brooklyn Gas Fixture Company has been awarded the contract for furnishing the gas and electric light fixtures for the new armory now under construction in Brooklyn for the 13th Regiment.

THE Rochester (N. Y.) Gas and Electric Company and the Brush Electric Company, of the same city, have appealed from the order of interlocutory judgment entered against them in favor of Edwin Einstein.

IN November last the quantity of gas made at the Wheeling (West Va.) City Gas Works is returned at 15,168,500 cubic feet; and the estimated output for December is 17,000,000 cubic feet.

ON the 15th inst. the jury in the case of the Spring City Gas Light Company, of Royersford, Pa., against the Schuylkill Valley Railroad Company, returned a verdict for plaintiff amounting to $15,000. The Railroad Company constructed its tracks over ground owned by plaintiff, and the award is for the land so taken. The Gas Company held that it was damaged to the amount of $25,000, and the defendant held that the Gas Company was really benefited by the construction of the track.

A LOCAL paper of Quincy, Ills., in describing a slight fire caused by a diverted electric current, manages to ring in this phrase: "The wires were *insulted*, and could have been handled without danger." Of course, 'twas only a typographical error—just a missing "a" twixt the "l" and the "t."

THE main gasholder of the York Light and Power Company, of Biddeford, Me, was completely wrecked by an explosion on the night of the 17th inst. The holder, which had a capacity of 65,000 cubic feet, was inclosed in a brick house with slate roof, and was fully inflated at the time of the disaster, which was brought about by the carelessness of an employee named McCarty, who entered the building, carrying with him an ordinary lantern. The wrecked vessel was constructed in 1891 at a cost of about $20,000.

MR. THOMAS ROBERTS WHITE, who died in Philadelphia about a fortnight ago, was at one time well known in the gas works building trade. Among the works constructed by him were those in the Northern Liberties, Spring Garden and Manayunk districts of Philadelphia. He also was connected with the building of one or more works on the Island of Cuba. He was born on November 1, 1819, in the town of West Falls of Schuylkill, Pa., and was a prominent Mason.

ENGINEER BARRET, of the Louisville (Ky.) Gas Company seems to be going into the incandescent electric lighting business on a huge scale, the Westinghouse Electric and Manufacturing Company, of Pittsburgh, having just completed for him an incandescent dynamo rated to furnish current to 10,000 lamps of 16 candle power each. The machine will be placed in the Company's Fourteenth street power house.

THE Spencer (Mass.) Gas Company has been again visited by fire, which wrecked the generating house. The damage is put at $5,000.

AT a session of the Board of Police and Fire Commissioners of Grand Rapids, Mich., the local Gas Company's bill for damages to a broken gas main was considered. The Superintendent of Public Works reported that the main which had been fractured was laid in 1888, and that a sewer was built in the street in 1889. On account of water and quicksand sheet piling was used in the trench, and the piling was allowed to remain when the excavation was filled in. Last fall the street was macadamized, and it is supposed that the 15 ton roller used in rolling the road drove the piling over on to the gas main and fractured it. The matter was finally referred to the City Attorney for an opinion as to whether the city, the sewer contractor or the paving contractor was liable for the damage done.

THE Appellate Court of Chicago has refused to issue an order continuing the injunction obtained by the North Chicago Street Railway Company against the city, restraining the latter from interfering with the operation of its gas motors. It is claimed that this means the exclusion of such motors for the operation of street railroad cars in the Windy City.

MRS. MAYRETTA CASE, of St. Johns, Michigan, has brought suit against the Mutual Gas Company, of that place, for $10,000 damages, on account of personal injuries sustained by her through her horse stumbling over an insufficiently covered pipe trench that had been opened by defendants.

THE Nanticoke (Pa.) Gas Company has been incorporated. It is capitalized in $25,000.

THE amount appropriated for the carrying on of the Philadelphia City Gas Works for the ensuing year is $2,922,288.

A SERIOUS explosion occurred at the Ogdensburgh (N.Y.) gas works on Saturday, December 16th. We have no particulars.

The Effect of Lightning on a Coal Pit

Mr. Charles Fergia, in the course of a paper read by him before the Mining Society of Nova Scotia, remarked:

The Scott pit shaft is 226 feet deep and down to the second seam, which is 12 feet thick, some 8 feet being worked. For some months past the only work done on this seam has been the driving of a pair of slopes to the deep to intersect the main seam by way of a tunnel already driven. The slopes are 2,000 feet down, and the driving of them was proceeded with until about the end of July last, when, in consequence of the colliery supply of water for steam purposes showing signs of giving out, they were stopped, and all work confined to the main slopes, the Scott pit being laid idle. Previous to this the mine had been ventilated by a Schiele fan, but having no steam to spare, in consequence of the scarcity of water, the fan was stopped and the mine received its supply of air by natural ventilation only. The seam being a very gassy one this mode of ventilation would not be sufficient to keep the mine clear, but as no person was to enter the mine until the normal state of affairs was again restored, it was not anticipated that any danger from an explosion of gas could possibly occur. The air of the mine being highly charged with firedamp, the necessary means of ignition were soon to be forthcoming. On the afternoon of August 8th there was an electric storm passing over the vicinity of the colliery, which discharged itself. The general office was struck by lightning and the front part of the building demolished. At the same time it struck the iron pulleys of the head frame at the Scott pit and traveled down the steel winding rope, entering the mine and instantly igniting the gas accumulated therein, which caused a severe explosion, the force of which demolished the buildings on the surface at the upcast, and at another shallow shaft called the "Stair pit."

The writer could not distinguish any lapse of time between the thunder clap and the explosion of the mine, so simultaneous were they. It being the opinion after the explosion that fire existed below, it was decided without delay, seeing that the ventilating shaft and fan were damaged, to seal up the mine, and this was done without mishap within about an hour and a half. The mine has since remained sealed. The writer will soon be in a better position to state the actual effects of the explosion underground. Though he has read of lightning having entered a mine by way of steel ropes, etc., the writer is not aware of any explosion having been directly traced to that cause before the one now referred to. This accident, which was happily unattended by loss of life, clearly demonstrates that no mine where gas is allowed to accumulate to an explosive point can be considered safe from an explosion when it is connected with the surface by conductors of electricity such as wire ropes, water pipes, steel rails, etc. It also serves to point out that where boreholes are put down from the surface for the purpose of rope haulage underground these holes and ropes should not pass through a return airway or where gas is likely at any time to be mixed with the air in high percentages.

The Market for Gas Securities.

The market for city gas shares showed some improvement for the week, Consolidated having made a net gain of one point, the opening bid price to-day (Friday) being 127 bid, as against 126 last Friday. The break was undoubtedly due to free offerings on realization account, aided by the general bearish feeling which seems to pervade the financial situation as a whole. Equitable is firm at last quotations, and Mutual is also in good request, although bidders are inclined to look for a concession from the 150 demanded by holders.

The Brooklyn situation is as incomprehensible as ever, but holders seemingly are satisfied since the recent increase in prices is more than maintained. The feature in Brooklyn shares was the rise in Nassau, for which 160 is bid. Citizens also showed strength. Chicago gas sold down during the week to 62¼, which was the opening to day. Consolidated, of Baltimore, is reported at 54¼ to 54½, Laclede is dull at 16 to 16½, and Bay State is lifeless at 15 to 15½. These shares ought to be a purchase at the reported prices. We note the following sales at auction: 25 shares Beckton Construction Company, preferred, at 80; $1,000 Peoples, of Brooklyn, 5 per cent. bonds, at 98½ and interest; 13 shares Middletown (Ohio) Gas Company at $25 for the lot.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

December 25.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	127	127¼
Central	500,000	50	90	95
" Scrip	220,000	—	—	100
Equitable	4,000,000	100	190	195
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	108	112
Mutual	3,500,000	100	145	150
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	80	95
" Bonds	150,000	—	—	100
Richmond Co., S. I.	346,000	50	50	65
" Bonds	20,000	—	—	—
Standard Gas Co—				
Common Stock	5,000,000	100	—	32
Preferred	5,000,000	100	—	77
Yonkers		50	112	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	115	120
Citizens	1,200,000	20	57	—
" S. F. Bonds	320,000	1000	—	101
Equity Gas Light Co	2,000,000	100	—	—
Bonds	1,000,000	—	25	40
Fulton Municipal	3,000,000	100	130	—
" Bonds	300,000		103	—
Peoples	1,000,000	10	82	85
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	98	100
Metropolitan	870,000	100	145	150
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	160	—
" Ctfs	700,000	1000	99	100
Williamsburgh	1,000,000	50	145	—
" Bonds	1,000,000	—	107	110

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As Superintendent of a Gas Works

by a young man of 20 years' experience in all details of the business—manufacturing, mechanical and clerical. Has made the stove business a specialty for the last 8 years. Best of references.

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WANTED,

A First-Class Draughtsman.

Must be thoroughly conversant with coal gas machinery. State previous employers and experience. None but first-class need apply.

966-tf Address, "X," care this Journal.

DIVIDEND NOTICE.

STANDARD GAS LIGHT CO. OF THE CITY OF NEW YORK,
71 BROADWAY, NEW YORK, Dec. 13, 1893.

The Board of Directors have this day declared a dividend of one (1) per cent. on the Preferred Stock of this Company, payable on Jan. 2d, 1894, to stockholders of record at 3 o'clock P.M., Dec. 20th, 1893.

Transfer books will be closed from 3 o'clock P.M., Dec. 20th, 1893, to 10 o'clock A.M., Jan. 3d, 1894.

967-3 FERDINAND McKEIGE, Secretary.

Proposals for Coal Tar.

The Lebanon (Pa.) Gas Company will receive bids for their

Tar Product of 1894,

making gas under old process from best Westmoreland gas coal. 250 barrels will be about the amount of the product. Bids will be opened Jan. 1, 1894, at 2 P.M.

966-3 JOHN W. MISH, Treas.

To Gasholder Builders.

ALTOONA GAS COMPANY,
ALTOONA, PA., Dec. 5, 1893.

Designs and bids will be received up to and including December 31st, 1893, for the erection of a

Three-Lift Gasholder, of One Million Feet Capacity, in a Steel Tank.

The several sections to be 30 feet deep each, and of the following diameters: Outer section, 123 feet; second section, 121 feet; inner section, 119 feet.

The designs and bids to be made for the above complete, and separate bids for the outer and second sections, with the columns so arranged that the third section can be added at any future time.

The Company reserves the right to reject any or all bids. Designs and bids to be addressed to Mr. John Lloyd, Prest., First National Bank, Altoona, Pa.

W. S. HUMES, Sec. JOHN LLOYD, Prest.

966 3

Valuable Gas Interest For Sale,

The undersigned will sell, to the extent of $20,000 to $50,000, in sums to suit purchaser, an interest in a growing gas business now netting 8 per cent.; increase this year will give net earnings of over 12 per cent. Money wanted for extensions to cover valuable territory. A magnificent opening for a party desiring a permanent occupation and investment in one of the most pleasant residence locations in California. Banks and business firms as references. Address for particulars and statement,

LOS ANGELES SAFE DEPOSIT AND TRUST CO.,
Stimson Block, corner Third and Spring Streets,
954-tf Los Angeles, California.

Read, Holliday & Sons, Ltd.

No. 7 Platt St., N. Y. City.

HYDRATED OXIDE OF IRON

For Gas Purification.

Analysis, Samples and Particulars on Application.

Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator.

Not Expensive. Write to STROH & OSIUS, Pat'ees, or Mich. Ammonia Works, Detroit, Mich

MOSES G. WILDER,

Mechanical Engineer,

816-822 Cherry St., Phila., Pa.

MANUFACTURER OF

Gas Governors,
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Gas Cocks and Fittings.

In addition to a full assortment of Volumetric Governors, etc., I am now making **MERCURY PRESSURE GOVERNORS** of all the usual sizes, adapted to use upon *Gas Stoves, Furnaces, and Meters*. The same careful attention to details of design and workmanship which has established the reputation of **WILDER'S VOLUMETRIC GOVERNORS** will be given to the new line. They have been thoroughly tested in many places during the past year, and have given entire satisfaction. The price is very low, and but for a complete system of machinery adapted to this work, it would be impossible to sell them at the price. I hope for large orders, as they become known, in consequence of the low price and good quality.

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FORT WAYNE, IND.

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For Arc Lighting, Direct Current Incandescent Lighting, Alternating Current Incandescent Lighting, Power Generators, Motors, Transformers, Instruments and Appliances.

The new "WOOD" Alternator and Transformers have a higher efficiency, better regulation and lower temperature than any others in the market. The Transformers are the easiest to install, the lightest weight, and the most artistic design of any yet produced.

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We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

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Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.

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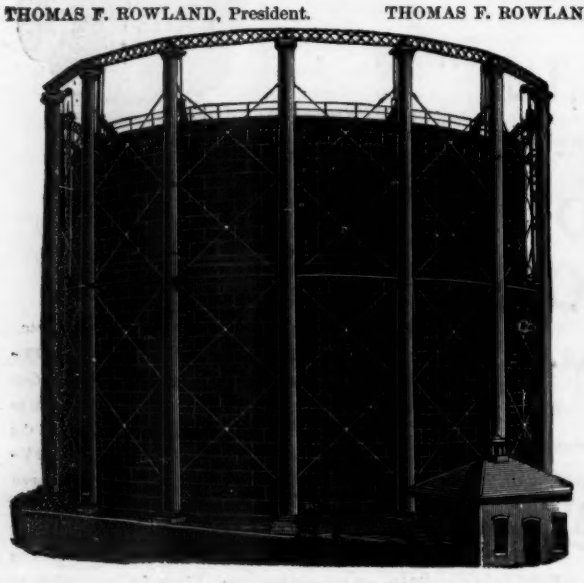

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Single and Multiple Section Gas Holders a Specialty.

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New Designs and

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The Largest and Most Complete Line ever Manufactured Under one Name.

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For 1893-94.

Send for Catalog of the Most Artistic Line of Heaters on the Market.

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The HAZELTON BOILER Frequently Called The PORCUPINE BOILER

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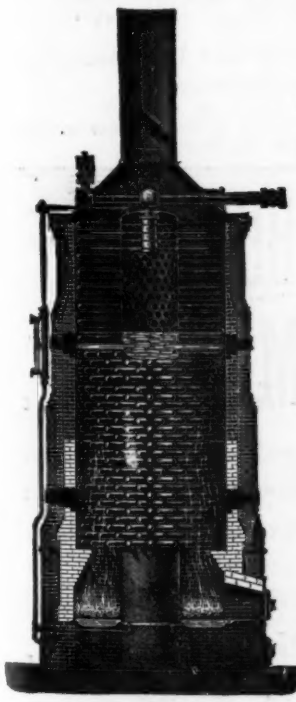

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An Unparalelled Record, of Over Twelve Years, for Economy, Durability, Safety, and Efficiency.

A Common-Sense High-Pressure Boiler made in a Superior Manner.

We Solicit for it the Critical Examination of the Mechanical Profession and the Steam-Using Public.

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Standard Sizes, 50 H.P. to 500 H.P.

THREE REGISTERED
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Special Sectional Boilers For Export.

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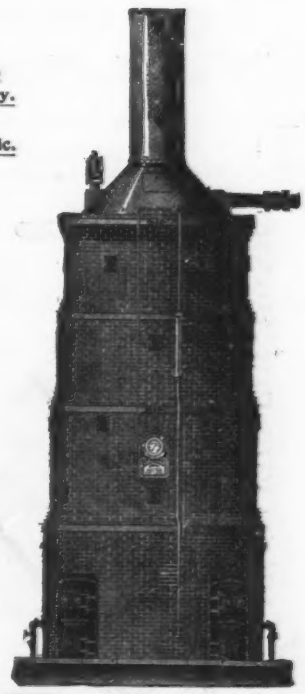
∴ BEWARE OF IMITATIONS. ∴

This Company is prepared to Manufacture and Furnish Plants of Boilers of any desired capacity, and will forward proposals and other information on application. All imitations of the substantial features of this Boiler are infringements, and will be prosecuted to the full extent of the law.



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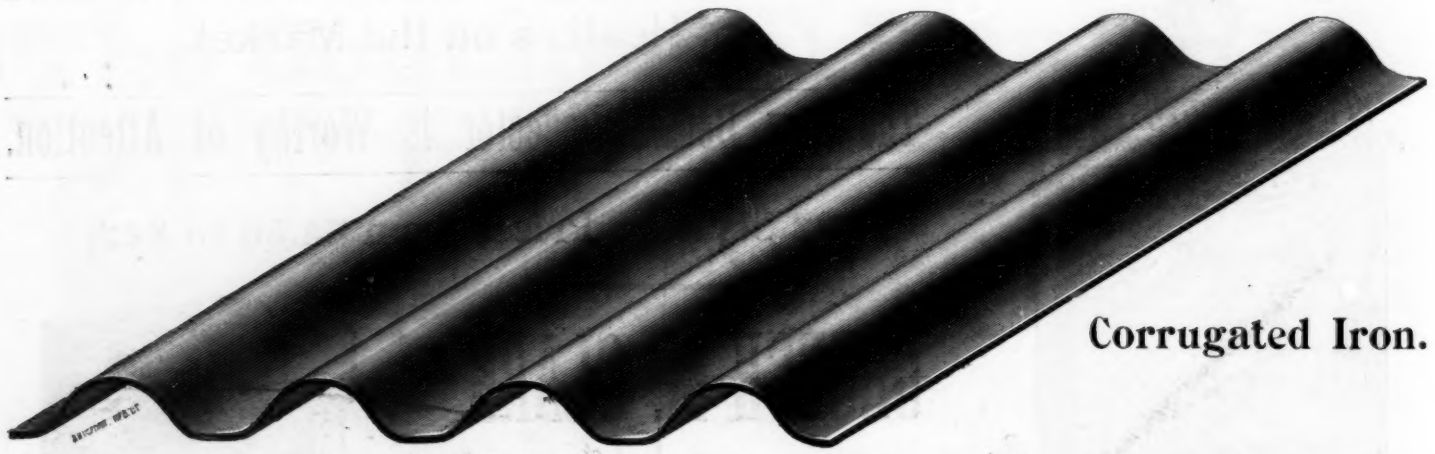

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We are prepared to furnish Corrugated Iron, painted both sides, all sizes and gauges. Our Oil Finished Corrugated Iron is superior in lasting qualities to any other in the market.

Write for Illustrated Catalogue.

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Double and Single Gate, ½ in. to 72 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, Oil and Ammonia.

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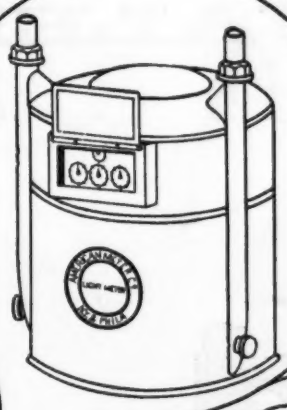

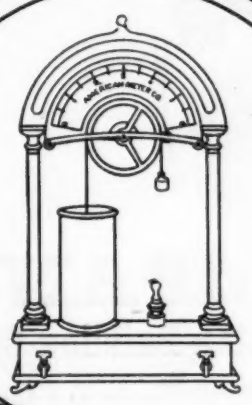

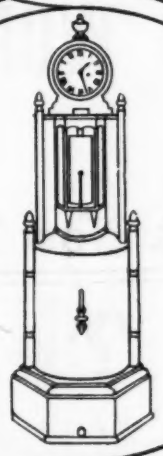

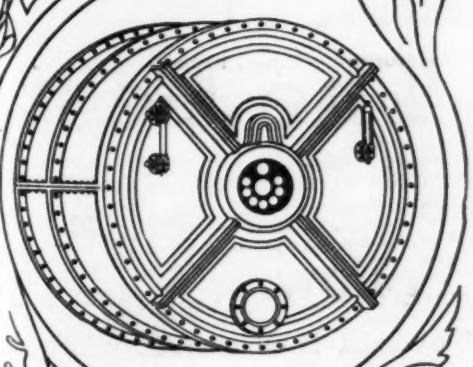

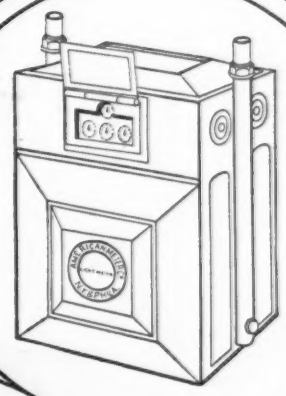

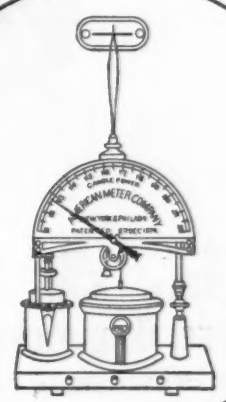

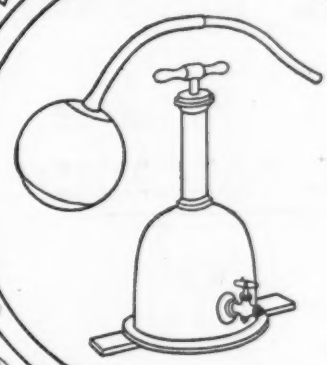

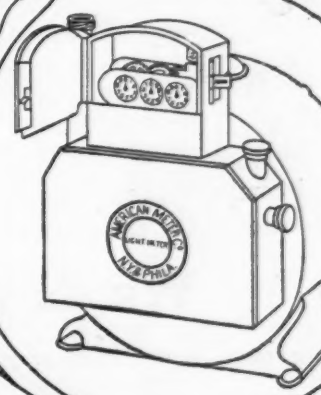

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ESTABLISHED 1834. INCORPORATED 1863.

NEW YORK and PHILADELPHIA.

CHICAGO, CINCINNATI,

ST. LOUIS, SAN FRANCISCO.

PUBLIC LIGHTING TABLE.

JANUARY, 1894.

Day of Week.	Table No. 1. FOLLOWING THE MOON. Date.	Light.	Extinguish.	Table No. 2. NEW YORK CITY. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Mon.	1	5.20 PM	4.30 AM	4.30	6.30
Tue.	2	5.20	5.30	4.30	6.30
Wed.	3	5.20	6.20	4.30	6.30
Thu.	4	5.20	6.20	4.30	6.30
Fri.	5	5.20	6.20	4.30	6.30
Sat.	6	5.20 NM	6.20	4.30	6.30
Sun.	7	5.20	6.20	4.30	6.30
Mon.	8	5.20	6.20	4.40	6.30
Tue.	9	5.20	6.20	4.40	6.30
Wed.	10	5.20	6.20	4.40	6.30
Thu.	11	8.30	6.20	4.40	6.30
Fri.	12	9.30	6.20	4.40	6.30
Sat.	13	10.30	6.20	4.40	6.30
Sun.	14	11.40 FQ	6.20	4.40	6.30
Mon.	15	1.00 AM	6.20	4.50	6.25
Tue.	16	2.10	6.20	4.50	6.25
Wed.	17	3.30	6.20	4.50	6.25
Thu.	18	4.40	6 20	4.50	6.25
Fri.	19	No L.	No L.	4.50	6.25
Sat.	20	No L.	No L.	4.50	6.25
Sun.	21	No L. FM	No L.	4.50	6.25
Mon.	22	5.40	7.30 PM	5.00	6.25
Tue.	23	5.40	8.50	5.00	6.25
Wed.	24	5.40	10.00	5.00	6.25
Thu.	25	5.40	11.10	5.00	6.25
Fri.	26	5.40	12.10 AM	5.00	6.25
Sat.	27	5.40	1.20	5.00	6.25
Sun.	28	5.40 LQ	2.20	5.00	6.25
Mon.	29	5.50	3.30	5.05	6.15
Tue.	30	5.50	4.30	5.05	6.15
Wed.	31	5.50	5.30	5.05	6.15

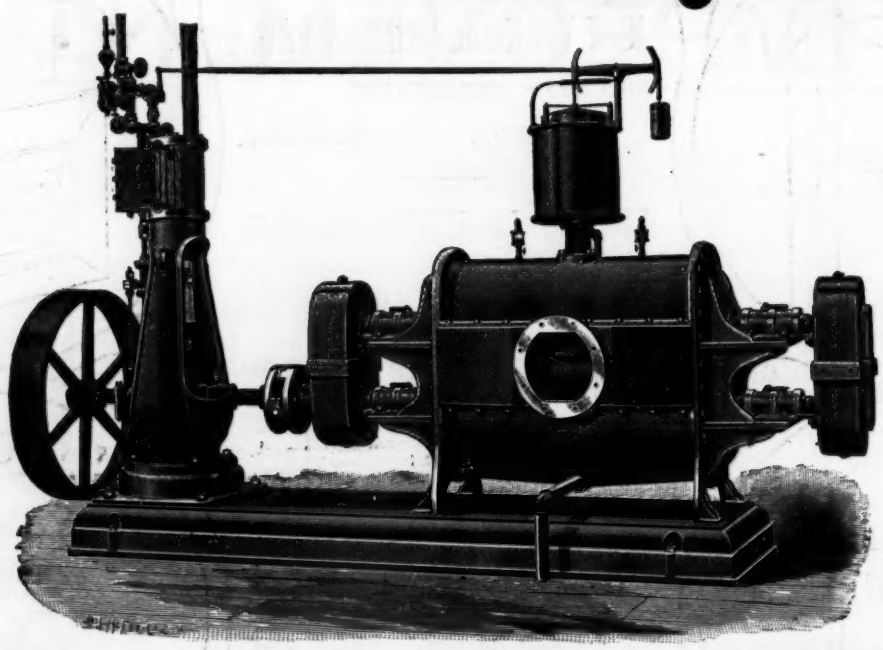
TOTAL HOURS LIGHTING DURING 1894.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	244.10	January	423.20
February	195.30	February	355.25
March	206.20	March	355.35
April	169.40	April	298.50
May	162.10	May	264.50
June	135.40	June	234.25
July	146.30	July	243.45
August	162.20	August	280.25
September	174.10	September	321.15
October	211.20	October	374.30
November	221.00	November	401.40
December	245.30	December	433.45
Total	2274.20	Total	3987.45

Roots' Gas Exhauster,

Having been in use twenty-five years, it speaks for itself, and stands

UNEQUALED!



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THE MANAGEMENT OF SMALL GAS WORKS.

By C. J. R. HUMPHREYS.

Price $1.

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If the

Cycloidal Exhauster

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The Best,

Why should competitors make such desperate efforts to **copy** all our new methods of construction? Isn't that indisputable evidence of the superiority of our machines?

We Lead, Others Try to Follow.

When you want a new Exhauster, write for prices to **the** firm prepared to build it on **correct** principles.

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THE UNITED GAS IMPROVEMENT CO.,

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Inquiries from any part of the United States should be addressed to the Philadelphia Office.

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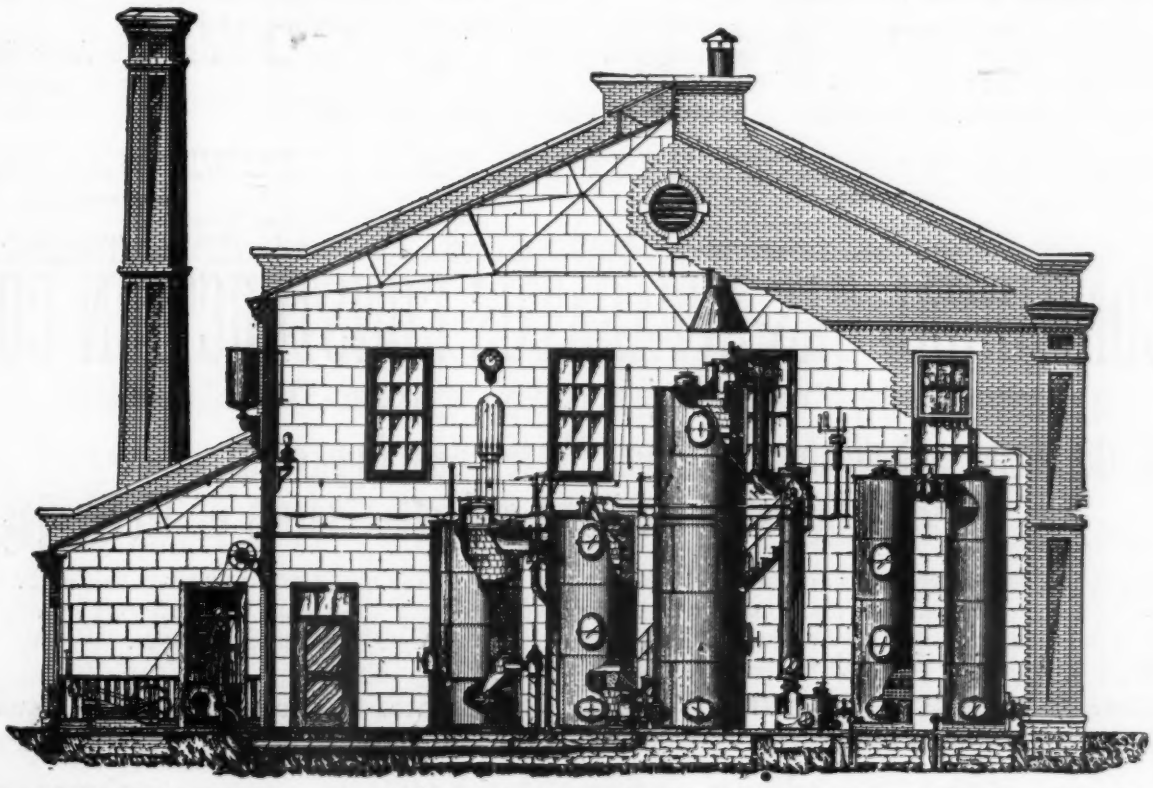
THE STANDARD LOWE WATER GAS APPARATUS.



Standard "Double Superheater" Lowe Apparatus, designed for the use of Naphtha, Crude Oil, or "Distillates."

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Water Gas Plants, either independent or auxiliary to Coal Gas Works, erected to meet any conditions. Apparatus designed to use any grade of Oil, and Anthracite Coal, or Gas House or Oven Coke.

PAMPHLETS, PLANS AND ESTIMATES FURNISHED UPON APPLICATION.

WATER GAS APPARATUS

BY THE

WESTERN GAS CONSTRUCTION CO.,

Of Fort Wayne, Ind.

The number of Water Gas Plants built by us this year fully testify to the merit of our **Improved** style of **Lowe Water Gas Apparatus.** Results obtained in the various sizes of our plants, up to over 900,000 cubic feet capacity per diem, show what can be attained in a well designed machine. We are prepared to **Guarantee Results,** as well as first-class construction. We build apparatus ranging in capacity from 50,000 cubic feet to 1,000,000 cubic feet per diem, and larger when required.

Our shop facilities are unexcelled, and enable us to quote prices which will prove interesting. The plants in operation demonstrate we have the **Experience** necessary to build Water Gas Apparatus on **Scientific** as well as **Practical** principles, and consequently **Build them Well.** Hence we don't hesitate to **Guarantee the Results.** We not only believe in "Water Gas on its merits," but also in building the apparatus at a price that will not only prove it a desirable investment as to the first cost, but produce results that will put the balance on the right side of your ledger.

There are three essential features in our design which we carefully considered as **Absolute Requirements:**

Durability, neatness, and compactness of the machine.

Minimum labor requirements for operation, and

Minimum amount of material required for results.

And when we add to this a minimum cost of a **Strictly First-Class Apparatus,** can you afford to be without it? If not, write us, and we shall take pleasure in proving our statements to be facts.

Also remember we are not exclusively building Water Gas Apparatus, but if you require **Any Apparatus** for **Coal or Water Gas** and want the latest and best designs, write us for prices, or we will execute carefully your own designs if desired, as we believe in giving you exactly what you want.

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For Continuous Records of

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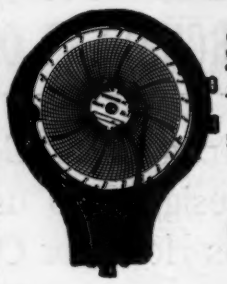

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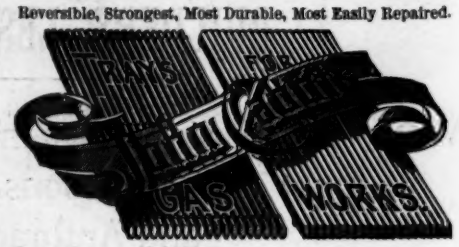
Reversible, Strongest, Most Durable, Most Easily Repaired.



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"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying material ever offered as a substitute for lime. We guarantee a large saving, both in cost of material and labor.

AUTOMATIC GOVERNOR.

OVER FOUR HUNDRED NOW IN USE! NO WORKS COMPLETE WITHOUT IT!
WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION!
REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE!
IT IS THE ONLY RECOGNIZED AUTOMATIC GOVERNOR IN THE WORLD!

STEAM JET EXHAUSTER. Designed particularly for small works. Combines Exhaust Tube, Steam Governor, Gas Compensator and Bye-Pass Valves in the most compact form possible. Occupies but little space; uses very little steam; saves formation of carbon in retorts; increases yield 10 to 15 per cent. No works too small to use them profitably.

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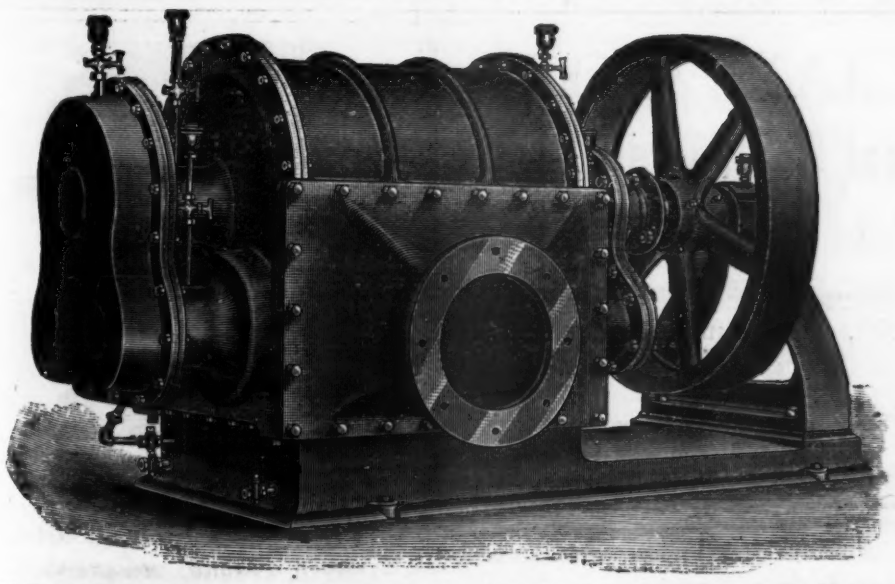
WILBRAHAM GAS EXHAUSTER



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IRON MASS

For Gas Purification.

Acts immediately, and more efficiently than any other purifying agent now in use.

Greenpoint Chemical Works.

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DOUGLAS' FERRIC OXIDE

For Gas Purification

Is a superior natural Hydrated Oxide of Iron. Will give a higher purification per bushel than any other material. We ship the pure Oxide of Iron, containing no sawdust, thus effecting a saving in freight, leaving the consumer to furnish the diluent at a nominal cost. It is now used by the largest gas companies in the West.

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GAS COALS. CANNEL COALS. COKE CRUSHERS.

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Old Kentucky Shale, From Kentucky.

TRADE **O. K. SHALE.** MARK.

THE MOST VALUABLE GAS ENRICHER NOW AVAILABLE IN ANY DESIRED QUANTITY.

S. CALVERT FORD, Government Inspector at Washington, pronounces this Shale

"ONE OF THE BEST GAS ENRICHERS THAT HAS BEEN OFFERED TO THE TRADE."

He reports it as giving:

12,553 Cubic Feet of 50-Candle Gas,
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AN EQUIVALENT OF 627,650 CANDLE FEET,

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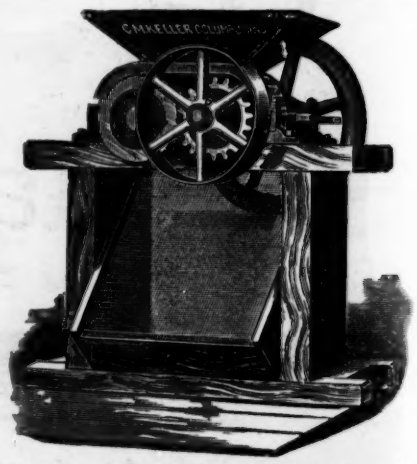

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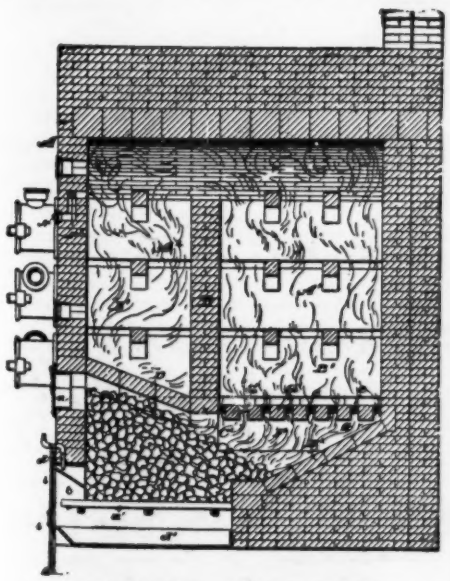

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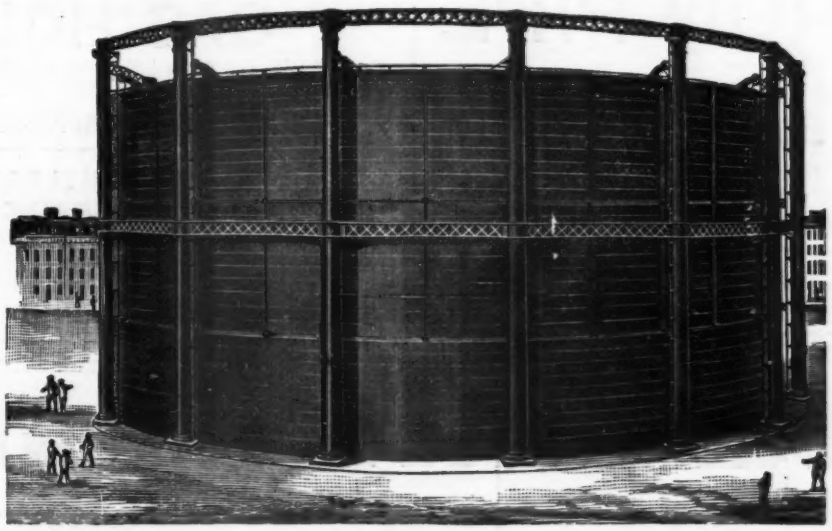

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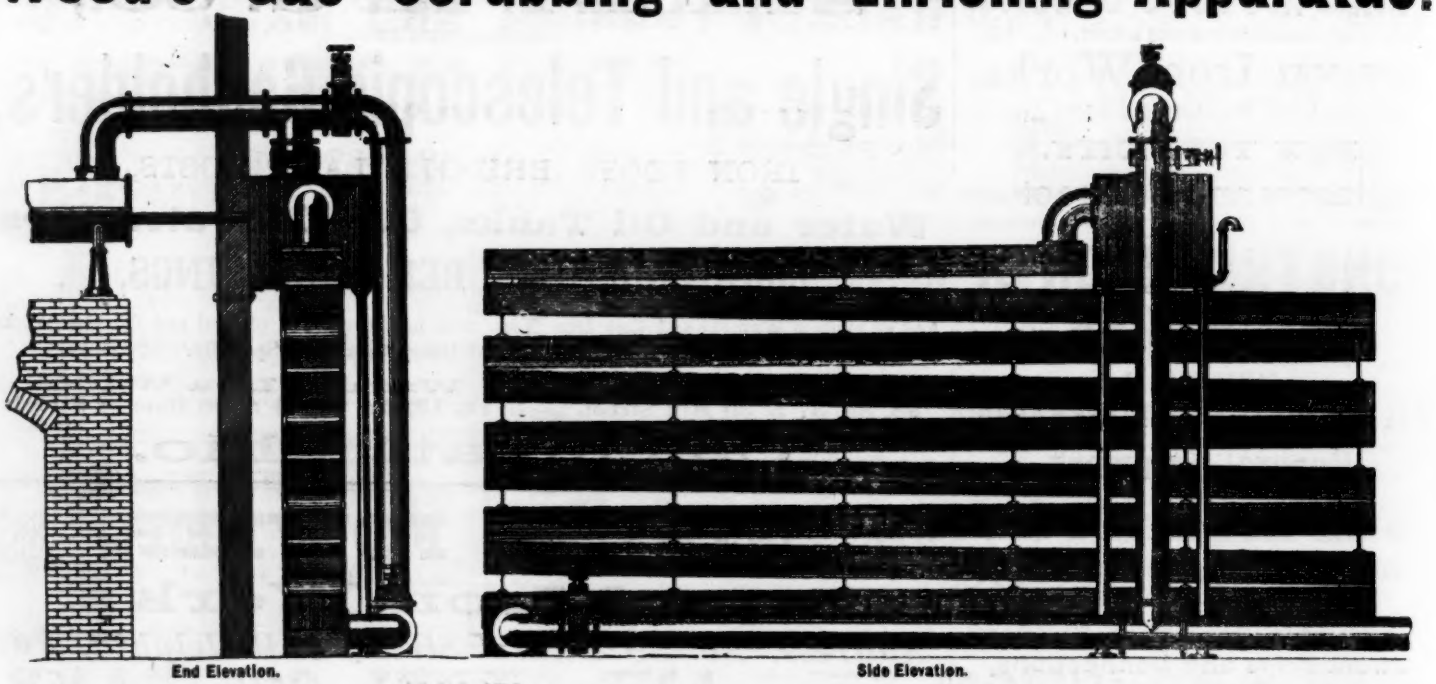

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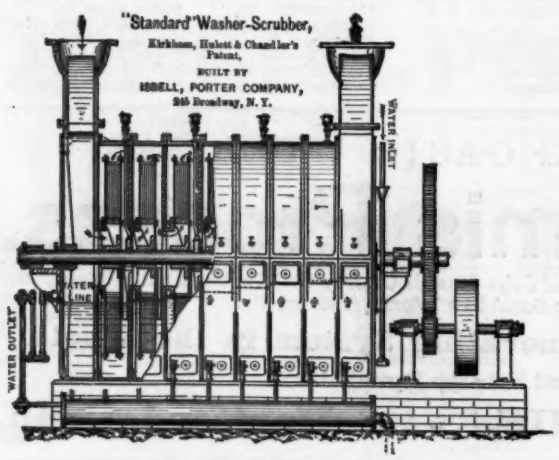

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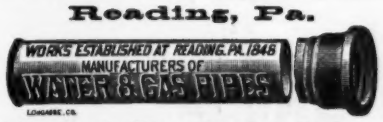

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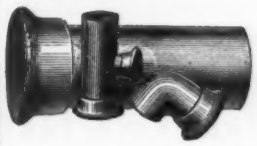

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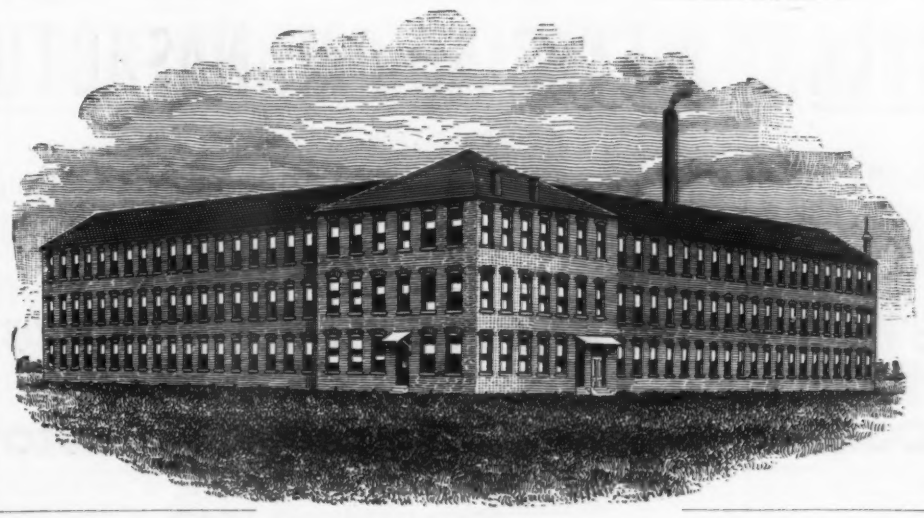

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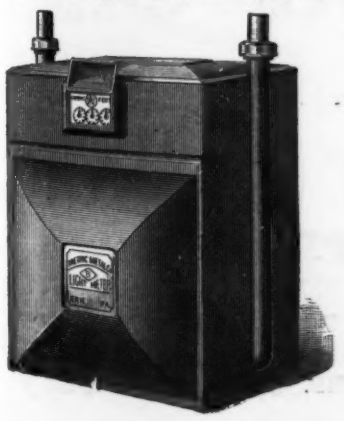

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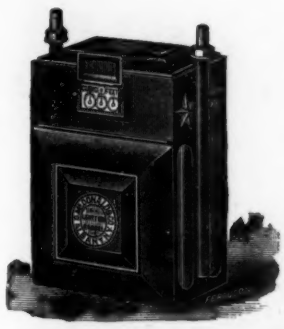

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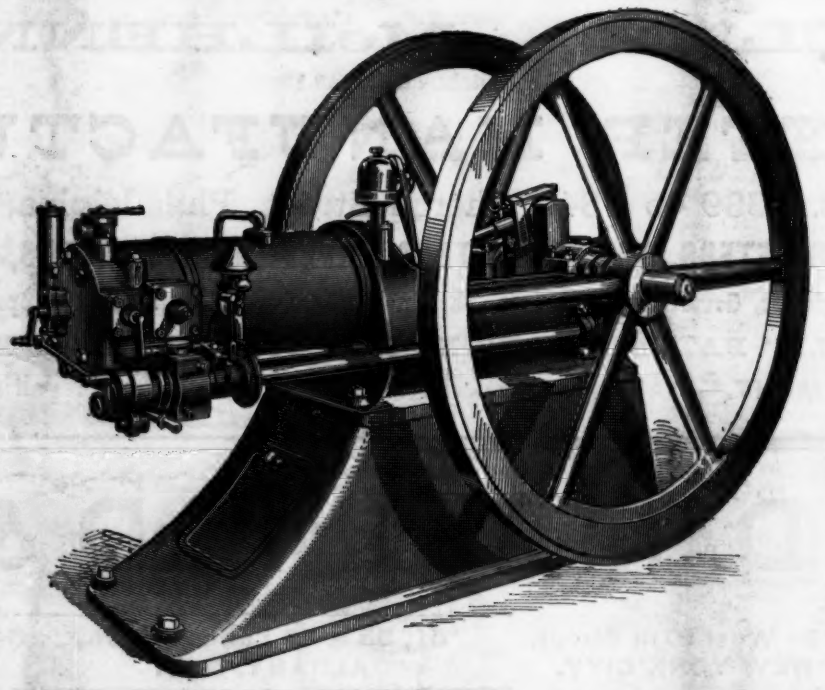

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